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FOSSIL BRYOZOA

IN THE

DEPARTMENT OF GEOLOGY

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CATALOGUE
OF
THE FOSSIL BRYOZOA
IN THE
DEPARTMENT OF GEOLOGY
BRITISH MUSEUM
(NATURAL HISTORY).

THE CRETACEOUS BRYOZOA.
VOLUME II. ✓

K with Vol. I.

✓ BY

J. W. GREGORY, D.Sc., F.R.S., F.G.S.

WITH NINE PLATES.

LONDON:
PRINTED BY ORDER OF THE TRUSTEES.
SOLD BY
LONGMANS & CO., 39 PATERNOSTER ROW, E.C.
B. QUARITCH, 11 GRAFTON STREET, NEW BOND STREET, W.
DULAU & CO., 37 SOHO SQUARE, W.
AND AT THE
BRITISH MUSEUM (NATURAL HISTORY), CROMWELL ROAD, S.W.
1909.

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HERTFORD:
PRINTED BY STEPHEN AUSTIN AND SONS, LTD.
SEPTEMBER, 1909.

PREFACE.

The publication of the second volume of the Catalogue of Cretaceous Bryozoa has been delayed by the Author's retirement from the staff of the British Museum, and his consequent occupation with other work. When Dr. Gregory left England in 1900 he had already completed part of the MS., with some of the illustrations; but it was not until 1905, after his return to this country, that he was able at intervals to devote some time to its continuation. Meanwhile, the collections of the Museum had so much increased, and additions to our knowledge of the subject had been so considerable, that a second volume proved inadequate to complete the Catalogue. Dr. Gregory therefore confined himself to an examination of the rest of the Cyclostomata, the few Trepostomata, and the single known extinct species of Phylactolæmata, leaving the Cheilostomata to form the subject of a concluding volume. It is hoped that this final part of the Catalogue will shortly be prepared by Mr. W. D. Lang, who succeeded Dr. Gregory as Assistant in special charge of the fossil Bryozoa.

A. SMITH WOODWARD.

Department of Geology,
British Museum (Natural History).
April 28, 1909.

AUTHOR'S PREFACE.

Since the first volume of this Catalogue was published in 1899, extensive additions have been made to the collection of Cretaceous Bryozoa, notably from the Chalk of Rügen; but circumstances have unfortunately prevented detailed references to much of this new material. The specimens acquired since 1900 have only been examined and described so far as they add previously unrepresented species of systematic importance. With a few special exceptions, only species and records earlier than the year 1900 are treated in detail.

The attempt to include all the described Cretaceous genera and species has involved the difficulty of placing the numerous genera founded by Hamm. Doubts have been expressed as to their value, but the descriptions are usually sufficient for their recognition, and there seems no adequate reason for their dismissal unnoticed. Several of his genera fill definite systematic gaps, and it is hoped that reference to them will stimulate search for further material from the rich Bryozoan limestones of Limburg.

During the preparation of the present volume of this Catalogue I have been indebted to Mr. Canu for information as to the horizons of the French localities; to Dr. A. W. Rowe for the loan of specimens and for information as to the distribution of Chalk species; to Mr. C. D. Sherborn for frequent bibliographic help and for his determination of the dates of the parts of d'Orbigny's volume on the Cretaceous Bryozoa and of Michelin's "Iconographie Zoophytologique," a research which renders necessary some alterations in the dates assigned to some parts of those works in the two previous volumes. Finally, I have much pleasure in expressing my special indebtedness to Dr. F. A. Bather for many suggestions made during his careful revision of the proofs, for checking several references to the literature and Museum Registers, and for passing the final proofs through the press during my absence from Europe. Also to Mr. W. D. Lang for his ready help when examining the collections, for numerous answers to questions, and for the Subject Index. I must also thank Miss Drake for the plates and figures, and Miss B. C. Smith for the Index to the systematic names.

J. W. GREGORY.

UNIVERSITY OF GLASGOW.
April 11, 1909.

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ERRATUM.

p. 34, line 9 from end, for *Domopora* read *Tholopora*.

INTRODUCTION.

The Cretaceous Bryozoan Fauna.

The Cretaceous Era is of special importance to students of Bryozoa, as it was practically the birth-time of the chief modern types of this class of animals. It is the era in the history of Bryozoa that corresponds to the Carboniferous with Echinoidea and to the Eocene with Mammalia. If the former method of separating the older from the modern types into such divisions as Palæocrinoidea and Neocrinoidea, or Palechinoidea and Euechinoidea, were adopted for Bryozoa, the separation between Palæobryozoa and Neobryozoa might be drawn between the Jurassic and the Cretaceous, and not in the great stratigraphical gap between the Permian and the Trias; for the existing groups of Bryozoa first became abundant after the great extension of European seas during the Lower Cretaceous.

The most characteristic Cretaceous Bryozoa belong to the Cyclostomata, and the members of that Order in the present seas are a comparatively few isolated survivals from the rich Cretaceous fauna. The gaps between the various living Cyclostomata are so wide that it is impossible from them to trace the phylogeny of this Order or to frame an adequate classification of it. Neither the embryology nor the morphology of the recent species can give the same help with the Cyclostomata as with the Cheilostomata, for in comparison with the living Cyclostomata, the Cretaceous are so abundant in species and so varied in structure that the usual definitions of the Order based only on the recent fauna are useless. Thus Busk's definition of the Cyclostomata, as revised by him in 1875, is as follows[1]: "Cells tubular, calcareous, partially free or wholly connate; aperture terminal, not furnished with a movable lip or fringe." There is nothing in this definition to separate the Cyclostomata from the Trepostomata, and the terminal position of the aperture, the main distinction from the Cheilostomata, is not true for some Mesozoic Cyclostomata. Thus the aperture in *Haplooecia* and in the Eleids is similar to that of the simpler Cheilostomata; while in some Cheilostomata, such as *Liriozoa*, the aperture is "almost terminal,"[1] and in *Bigemellaria* it is "subterminal."[2] In *Liriozoa*, in fact, the aperture is as plain and simple as in ordinary Cyclostomata.

---

[1] G. Busk. Cat. Mar. Polyz. Brit. Mus. pt. iii., Cycl. 1875, p. 2.

Hincks'[3] definition of Cyclostomata—"Zoœcia tubular, with a plain, inoperculate orifice; marsupial and appendicular organs wanting"—is also useless when the Cretaceous fauna is included. Of its five statements three are negative; a fourth, the tubular nature of the zoœcia, is equally true of some Cheilostomata, as is shown by Hincks' own diagnosis of the Æteidæ; and the fifth character, the plainness of the orifice, is an assumption that can only be tested on well-preserved recent species, and cannot be verified in the case of any fossils or of the majority of recent museum specimens.

Three Orders of Bryozoa, including five distinct groups, entered the Cretaceous from the Jurassic.

1. Trepostomata, an Order comprising forms with a massive zoarium composed of tubular zoœcia. This Order survived from the Palæozoic, and lingered to the Cainozoic. The Trepostomata are abundant in the Lower Cretaceous, but they become much scarcer and the forms smaller in the Upper Cretaceous, and these changes mark the decline in the importance of the Order.

2. The Cyclostomata are the predominant Bryozoa in the Cretaceous, and the Order is represented by three suborders, each of which dates from the Jurassic. They are—

(*a*) Tubulata, the dominant forms in the Jurassic, which in the Cretaceous attained their maximum of number and variety.

(*b*) Dactylethrata, an offshoot from the Tubulata, in which the zoarium is increased in complexity by the presence of dactylethræ.

(*c*) Cancellata, in which the walls of the zoœcia are perforated by cancelli. True cancelli, which are cavities in the walls of the zoœcia, though of interzoœcial origin, have to be distinguished from interspaces between adjacent zoœcia.

---

[1] P. H. MacGillivray. Monogr. Tert. Polyz. Victoria: Trans. Roy. Soc. Vict. iv. 1895, p. 6.

[2] *Ibid.* p. 7.

[3] T. H. Hincks. Brit. Mar. Polyz. 1880, p. 1.

3. Cheilostomata, of which two species are known from the Jurassic, are represented in the Cretaceous by a large fauna, which begins with the simple Athyriata, and includes in higher Cretaceous horizons members of the chief divisions of the Order.

The Cheilostomata are the predominant Bryozoa in existing seas, and first became important in the Upper Cretaceous. They began in the Jurassic, but in that system they are extremely scarce. There are, in fact, still only two known Jurassic species, and until others are discovered to connect them with the Cretaceous fauna it is impossible to avoid some suspicion as to the horizon from which they came. The Jurassic Bryozoa are still so little known that there appears no adequate reason to disbelieve the Museum labels as to the source of the Museum specimens of the Jurassic Cheilostomata. They belong to the Tesson Collection, are duly labelled, and resemble Ranville material. Moreover, one of the species was recorded by Lamouroux from the Bathonian of Ranville. Nevertheless, those two species are so isolated that they afford a striking instance of the imperfection of the palæontological record; and, until other Jurassic Cheilostomata have been found, it is impossible to avoid some doubt as to their horizon.

Descriptive Nomenclature.

Many of the general questions connected with the fossil Bryozoa, their typical structure, and the chief terms used in their description were dealt with in the Introduction to the Catalogue of the Jurassic Bryozoa (1896), but further explanations are necessary in respect to some of the terms.

Ovicells. — The term 'ovicell' seems to me best used in a general sense for the various structures developed in Bryozoa for the protection of the ova. It may thus be used to include the oœcium of the Cheilostomata, the gonœcium of many Cyclostomata, and that type of ovicell for which the name gonocyst was proposed in the Jurassic Catalogue. These three structures seem distinct in character and origin, and are therefore best described by special names.

The term 'gonocyst' has been criticized by Dr. S. F. Harmer[1]; but the distinction between the three types has been strongly supported by his careful researches on the origin and nature of ovicells.

---

[1] S. F. Harmer. "Notes on Cyclostomatous Polyzoa": Proc. Camb. Phil. Soc. vol. ix. pt. iv. 1896, pp. 211–12.

Thus, considering first the Cheilostomatous 'oœcia,' Dr. Harmer has remarked that these structures are "probably not homologous with those of Cyclostomata"[1]; for, as he points out, an oœcium or ovicell in a Cheilostome is probably an appendage of a zoœcium and not a modified zoœcium.

The second term, 'gonœcium,' has long been widely accepted for a Cyclostomatous ovicell which is developed from a single expanded zoœcium. Thus Dr. Harmer, in his paper on "Embryonic Fission," describes the ovicell as "indeed merely a modified zoœcium, as is shown by the method of its development, as well as by its internal structure."[2] Ovicells which are derived from the expansion of simple zoœcia, and are therefore true gonœcia, occur in the genera *Crisia* and *Entalophora*.

The third term, 'gonocyst,' was proposed for the ovicell which differs from a gonœcium, as it is not due to the modification of a single zoœcium. The original definition is as follows: "A form of marsupial chamber produced by expansion within the zoarium, and not by the modification of a single zoœcium." *Berenicea parvitubulata* (Cat. Jur. Bry. Pl. IV. Fig. 5) was then quoted as an example. Dr. Harmer,[3] however, objects that "the ovicell is probably a modified zoœcium in all Cyclostomata." But the essential difference between gonœcia and gonocysts appears to be established by Dr. Harmer's own careful researches on '*Lichenopora*' *verrucaria*, described in a memoir published shortly after the issue of the Jurassic Catalogue.

It has in fact been long recognized that the ovicells of Cyclostomata include two distinct types of structures. Thus Smitt proved the ovicell of '*Lichenopora*' *verrucaria* to be a chamber formed from interstitial, i.e. interzoœcial, spaces, and not from zoœcia.[4] It is also implied in his account and figures of a specimen of '*Idmonea*' *milneana*, which he describes as having "the tip of the stem dilated for the formation of an oœcion";[1] whereas in the same paper he describes the oœcia of *Entalophora deflexa* as similar to those of *Crisia*,[2] and they are probably true gonœcia, as in many fossil species of *Entalophora*.

---

[1] S. F. Harmer. "On the Occurrence of Embryonic Fission in Cyclostomatous Polyzoa": Quart. Journ. Micro. Sci. vol. xxxiv. pp. 199–241, 1893; see p. 233.

[2] *Ibid.* p. 204.

[3] S. F. Harmer. Proc. Camb. Phil. Soc. vol. ix. 1896, p. 211.

[4] F. A. Smitt. "Kritisk förteckning öfver Skandinaviens Hafsbryozoer": Öfvers. k. Vet.-Akad. Förhandl. 1867, vol. xxiii. p. 479.

MacGillivray[3] also recognized that the 'oœcia' of his Tubuliporidæ were inflations of part of the zoarium and were not zoœcial. This origin seems to me clearly established by Dr. Harmer's work on the development of '*Lichenopora*,' for the term gonocyst was intended for the structures that Dr. Harmer[4] describes as "a large compound ovicell." He agrees with Smitt, and gives more convincing proof that these ovicells have been formed from interstitial, i.e. interzoœcial, spaces; they are further enlarged, according to Dr. Harmer (*op. cit.* p. 91), by the absorption of "blister-like spaces" in the zoarium. As such ovicells are not homologous with those of *Crisia*, it seemed desirable to call them by a distinctive term, and 'gonocyst' was therefore proposed.[5]

The original definition was intentionally indefinite as to the exact nature of these gonocysts, and they were simply described as expansions within the zoarium, as that description would cover all indefinite cavities, whether formed by the fusion of several zoœcia, or from interzoœcial spaces, or from both combined.

Smitt's observations on '*Lichenopora*' *verrucaria*, as quoted above, with his record of eight openings from one ovicell and my dissections of some Jurassic *Berenicea*, both supported the probability that gonocysts included both interzoœcial and zoœcial spaces. After the interzoœcial space is roofed over, it may expand laterally and possibly absorb the walls of the adjacent zoœcia. Such Bryozooites would be cut off from the surface and their existence as normal members of the colony rendered impossible; but they might be revived as reproductive zooids and discharge their products into the chamber of the gonocyst. Dr. Harmer has shown that large compound ovicells are probably formed of several zoœcia, for he remarks (*op. cit.* p. 137), "in the cases where two or more zoœcia become fertile, the ovicell may be regarded as being composed of as many original zoœcia."

---

[1] F. A. Smitt. "Floridan Bryozoa," pt. i.: Handl. k. Sv. Vet.-Akad. vol. x. No. 11, 1872, p. 19, pl. iii. fig. 16.

[2] *Ibid.* p. 12, pl. v. fig. 30.

[3] P. H. MacGillivray. "A Monograph of the Tertiary Polyzoa of Victoria": Trans. R. Soc. Vict. vol. iv. 1895, p. 129.

[4] S. F. Harmer. "On the Development of *Lichenopora verrucaria*, Fabr.": Quart. Journ. Micro. Sci. vol. xxxix. pp. 71–144, 1896; see p. 72.

[5] Dr. Harmer, to whom these paragraphs have been shown at the request of the Author, considers that his paper "On the Development of *Tubulipora*" (Quart. Journ. Micro. Sci. vol. xli. pp. 73–157, 1898) still precludes the acceptance of this view.

Dr. Harmer's work, therefore, appears fully to justify the distinction between gonœcia and gonocysts, and to support the view that several zoœcia may help in the formation of a large gonocyst.

Epizoarium.—This term is adopted for that epizoarial layer for which the term epitheca has been borrowed from the descriptive nomenclature of corals. This layer to some extent corresponds to the epitheca of corals, but is more important and varied in its functions; and as there is no theca in Bryozoa, the term epitheca is inappropriate. [The term 'epizoarial' was suggested in Vol. I. p. 129, but 'epithecal' was then retained.]

Cancelli.—Spaces of interzoœcial origin which remain either as simple or branched tubuli, or as maculæ, round spots or spaces, in the walls of the zoœcia.

The term 'cancellus' has been variously used. Thus both H. A. Nicholson and Busk regarded cancelli as aborted zoœcia in dimorphic zoaria, for which structures I have adopted Ulrich's term 'mesopores.' Smitt, Mr. Waters, and Dr. Harmer, on the other hand, regarded cancelli as derived from interzoœcial spaces.

Mr. Waters[1] has devoted a couple of pages of his report on the Belgian Antarctic Expedition's Bryozoa to comment on what he regards as the inconsistency between my use of the term cancelli in 1893 and 1896. He, however, compares a difference of two books published at a three years' interval, while he himself made greater changes in the use of 'cancelli' in two papers published three months apart (cf. pp. xxxiii, xxxiv).

The changes between my Catalogues of 1893 and 1896, moreover, are more apparent than real. Mr. Waters remarks that I used 'cancelli' as a zoarial character in 1893 and as zoœcial in 1896.

---

[1] A. W. Waters. Bryozoa: Expédition Antarctique Belge—Résultats du Voyage du S.Y. Belgica en 1897–9: Zoologie, 1904, pp. 95, 96.

But this was not so. I have endeavoured throughout to confine the term 'cancellus' to spaces of interzoœcial origin; but in some genera the cancelli remain as large spaces; in others they persist as long cylindrical spaces forming tubuli; while in others they are only pores left, like the lunules of some Echinoids, by overgrowth of calcareous tissue. In the last case the cancelli may be so small and abundant that they render the walls porous or cancellous.

In 1896 I regarded cancelli as of two main types: long cylindrical tubuli in the epizoarium, as in the Horneridæ, and the simple round spaces or spots for which the term 'maculæ' was suggested in 1892,[1] and which are typically represented in the Petaloporidæ.

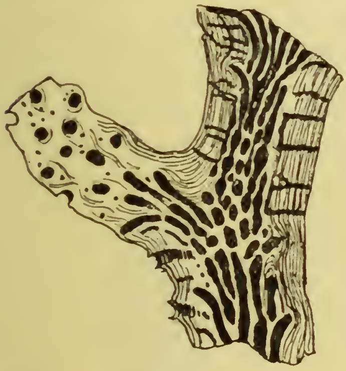

FIG. 1.—*Hornera lichenoides* (Linn.). Recent: Norway. Longitudinal section; × 12.

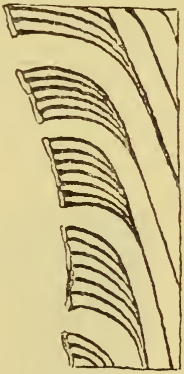

FIG. 2.—*Petalopora costata* (d'Orb.). Longitudinal section through wall with maculæ. (After Počta.)

In both cases the cancelli appear to be extra-zoœcial in origin, though when surrounded by the overgrowth of the thickening walls of the zoarium they appear ultimately zoœcial. The origin and relations of the two types of cancelli may be illustrated by Figs. 1 and 2, reprinted from Vol. I of this Catalogue. Fig. 1 shows the tubuli of *Hornera* (the 'pore-tubes' of Waters) traversing the outer layers of the zoarium. These pore-tubes were, of course, occupied by "protoplasmic and cellular contents," to use Waters' statement; these soft materials were no doubt zoœcial in origin, and maintained a connection between the zoœcia and the tissues secreting the epizoarium, just as the ordinary interzoœcial spaces were occupied by the soft tissues which cover the surface of the zoarium. But as the tubuli were spaces left in secondary calcifications outside the zoœcial cavities, they may be regarded as extra-zoœcial in origin.

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[1] J. W. Gregory. "On the British Paleogene Bryozoa": Trans. Zool. Soc. vol. xiii. 1893, p. 221.

The origin of round spaces or 'maculæ' by the irregular thickening of the wall of the zoarium is shown in Figs. 2 and 3. Fig. 2 is a diagram of the structure of *Petalopora* after Počta, and Fig. 3 shows the actual structure as seen in a thin section of *Sparsicavea undulata*; in that species there are two or three maculæ between adjacent peristomes, and they are formed as pits, left by the thickening of the outer wall. Some of the longer maculæ are divided by a transverse tabula. A condition intermediate between the typical short maculæ and the long tubuli is shown by some long and thin maculæ in *Sparsicavea undulata* (Fig. 3), which approximate to the branched tubuli of *Siphodictyum gracile* (Fig. 4).

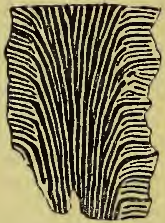

Fig. 3.—*Sparsicavea undulata* (Hag.). Longitudinal section; × 7·5.

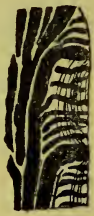

Fig. 4.—*Siphodictyum gracile*, Lonsd. Longitudinal section through wall with maculæ.

As to the nature and classificatory value of cancelli, I have not seen reason for any serious change of opinion since I used that term in 1893, though I then cautiously defined cancelli in more general terms than are now necessary. But Mr. Waters is quite just in his suspicion as to a change of view regarding the cancellous nature of the Discoporellidæ (Lichenoporidæ of many authors). And upon that question I am still undecided. No final opinion appears to me possible until there has been a complete revision of the miscellaneous assemblage of recent species included under the name of *Discoporella* by Busk and of *Lichenopora* by Waters.

In 1893 I followed Busk[1] in regarding the small pores in *Discoporella* (*'Lichenopora'*) as the openings of cancelli, and therefore included the family Discoporellidæ in the Cancellata. But in 1896 I became very doubtful as to the nature of these structures in the Discoporellidæ, for many of the pores appeared to me to be mesopores, and if so, *Discoporella* should be included in the Trepostomata. On the other hand, in 1896 Harmer[2] published his memoir on the development of *'Lichenopora' verrucaria*, and showed that in the young colony, as far as he traced its history, there were cancelli derived from interzoœcial spaces, but no mesopores. Harmer is emphatic that the alveoli from which the cancelli are formed are not suppressed zoœcia.[3]

If Harmer's account be complete, then *'Lichenopora' verrucaria* is cancellate, and my opinion in reference to the Discoporellidæ in 1893 was correct. But there are two uncertainties. (1) The adult *'Lichenopora' verrucaria* may have mesopores, though none had been formed in the young zoaria of which the development had been traced by Dr. Harmer. (2) *Discoporella* (*'Lichenopora'*) may contain some species with cancelli and others with mesopores. It appears not improbable that such species as *D. verrucaria* have cancelli and others, e.g., *D. hispida*, *D. novæzelandiæ*, and *D. holdsworthi*, have mesopores. Mr. Waters[4] has objected to the view that *'Lichenopora'* and *Hornera* can be included in the same sub-order; and as regards the three species last-mentioned he is probably correct.

Among the Cretaceous species that have to be considered in reference to *Lichenopora* is the genus *Discocavea*, which may be cancellous and not mesoporous. Unfortunately the attempt to decide its structure by the examination of thin slices has failed, as the specimens crumbled and were lost in the process of section-cutting; and the number of specimens in the collection was not enough to justify the sacrifice of more.

Sections of *Radiopora* show that it has mesopores and not cancelli, and as I am not aware of any definite separation between it and *Discocavea*, it seems safest now to place the whole of the series from *Discocavea* to *Radiopora* in the Trepostomata. *Discocavea* may be a decadent Trepostome, but it is quite possible that it may be cancellous, in which case the genus should be removed from the Radioporidæ and restored, with any living cancellous, non-mesoporous species now included with the Discoporellidæ ('Lichenoporidæ'), to the Cancellata.

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[1] Busk. B.M. Cat. Mar. Polyz. pt. iii. p. 30. "Surface cancellated or porous" is given as one of the characters of the Discoporellidæ.

[2] S. F. Harmer. "Development of *Lichenopora verrucaria*": Quart. Journ. Micro. Sci. vol. xxxix. p. 90.

[3] *Ibid.* p. 135.

[4] A. W. Waters. Bryozoa: Expéd. Antarct. Belge, p. 96.

This question may, however, well await the result of a revision of the living species assigned to that family, and more definite knowledge of the structure of living *Tholopora*.

THE CLASSIFICATION OF THE CYCLOSTOMATA.

The Cyclostomata are the characteristic Cretaceous Bryozoa, and the Cretaceous fauna supplies the best materials for the natural classification of that Order.

The classification of Cyclostomata is beset with two great difficulties. One is comparatively superficial, as it is only quantitative; the other is fundamental and qualitative.

The quantitative difficulty is that the variability of Cyclostomata is so great that there is an irreconcilable difference of opinion as to the value of the characters used as generic distinctions. Some heroic authors are prepared to repudiate all questions of convenience, and try to follow rigid and logical rules. They decline, for example, to recognize the difference between adnate and erect growth as of generic value, and the retention of *Proboscina* and *Stomatopora* has been declared retrograde.

It is no doubt true that under some circumstances a zoarium that, under normal conditions, would be adnate, may be forced to become partially free and erect. Thus if a *Berenicea* grow attached to a thin cylindrical stem, the growing edges of the zoarium will meet from opposite sides of the stem; and their further adnate growth in this direction being thus prevented, the two edges may project from the stem growing back to back, as a free bilaminar sheet. Such cases are exceptional, and even their free portions are really adnate, as they consist of two sheets growing adnate to one another.

Analogy with other classes of animals supports the probability of so great a difference in mode of life as that between an erect or adnate growth being of generic value. Thus, to quote an instance from such primitive organisms as the Foraminifera, the essential difference between Brady's two genera, *Rhizammina* and *Sagenella* (altered to *Sagenina* by Chapman[1] owing to the prior use of *Sagenella* among Bryozoa), is that *Rhizammina* is free and *Sagenina* attached. There are Foraminifera in which the shell is either free or attached, as they may grow either on a shell or resting loosely on the sea-floor; and no doubt many zoological classes include some members that have a free mode of life and others that are attached; but the consequent differences have led to their being usually assigned to different genera and often to different families. So great a difference in habit in such comparatively highly organized animals as the Bryozoa seems to be a natural generic distinction; but it also has the recommendation of convenience, for the same specific names have been used in different genera, and a merging of genera would necessitate confusing changes in the names of the species.

I am, therefore, glad that the 'retrograde' step of the recognition of *Berenicea* has been taken by most recent writers on the Cyclostomata; for if such genera be abandoned, the nomenclature of the Cyclostomata concerned will be hopelessly confused.

Differences of opinion as to the value of some characters only affect names, but the Cyclostomata are also troubled with differences as to the fundamental principles of classification.

The Order Cyclostomata was founded by Busk in 1852,[2] but the first important classification based on adequate representation was that by d'Orbigny.[3] His classification included most of the then known Bryozoa. His work, prepared after many years' study of recent and fossil Bryozoa and based on a very large collection of both, is probably the most important single work in the whole literature of Bryozoa. It was issued in parts from 1851 to 1854, but many of d'Orbigny's new genera were known from preliminary diagnoses in 1849.[4]

The classification adopted by d'Orbigny was greatly modified during the progress of his work. He began under the influence of an idea which has attracted most workers on Bryozoa, and completely fascinated some; he believed that the zoœcial characters were of primary importance, and that any sound classification would be based entirely on them. So he divided the Bryozoa into three Orders,[1] the *Bryozoaires Cellulinés* or *Cellulinæ*, the *B. tubulinés*, and the *B. foraminés*; the three Orders were founded on the characters of the zoœcium or 'cellule,' it being *cellulée*, *tubulée*, or *foraminée* respectively. But d'Orbigny discovered by 1852 that a classification on zoœcial characters alone was impracticable. He was forced to adopt a new classification,[2] in which zoarial characters were given due and sometimes exaggerated value. He then adopted two orders, the *Bryozoaires Cellulinés*, with short zoœcia growing in close juxtaposition, and the *Bryozoaires Centrifuginés*, with very long, tubular zoœcia, with a centrifugal growth.

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[1] F. Chapman. The Foraminifera, 1902, p. 127.

[2] G. Busk. In Voyage H.M.S. "Rattlesnake," vol. i., App. p. 346.

[3] A. d'Orbigny. Paléont. française, Terr. crétacés. Bryozoaires.

[4] A. d'Orbigny. Prodrome de Paléontologie, etc.

The groups were subdivided as follows:—

Order CELLULINÉS.

Suborder I. C. Radicellés. Zoarium chitinous or semi-calcareous, and attached by chitinous or stoloniferous 'radicelles' (roots).

a. Non-articulate. The Acamarchisidæ, Flustridæ, and Electrinidæ.

b. Articulate. Catenaridæ and Cellaridæ.

Suborder II. C. Empâtés. Zoarium calcareous; attached directly, without 'radicelles.'

Section 1. Zoœcia with medium-sized aperture, not closed by chitinous membrane. Fam., Escharidæ, Escharinellidæ, Porinidæ, Escharellinidæ, Escharellidæ, Porellidæ, Porellinidæ, Eschariporidæ, and Steginoporidæ.

Section 2. Zoœcia with large aperture, closed by chitinous membrane. Fam., Flustrellaridæ, Flustrellinidæ, and Flustrinidæ.

Order CENTRIFUGINÉS.

Suborder III. C. Radicellés. Zoarium attached by stoloniferous, chitinous roots. Fam., Serialaridæ and Crisidæ.

Suborder IV. C. Empâtés. Zoarium attached directly without roots.

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[1] 1851. *Op. cit.* pp. 22, 23.

[2] *Op. cit.* pp. 311 et sqq.

Section 1. *C. Operculés.* Operculum present. Fam., Eleidæ and Myriozoumidæ.

Section 2. *C. Fasciculinés.* Zoœcia inoperculate. Zoarium formed of bundles of zoœcia. Fam., Fascigeridæ and Fasciporidæ.

Section 3. *C. Tubulinés.* Zoœcia inoperculate. Zoarium variable in form, the zoœcia being arranged irregularly, radially, or in linear series. Fam., Tubigeridæ, Sparsidæ, Clausidæ, Crisinidæ, and Caveidæ.

Section 4. *C. Foraminés.* Zoœcia inoperculate. Zoarium "excessively variable" in form. Peristomes not projecting above the surface of the zoarium. Fam., Ceidæ, Cavidæ, Cytisidæ, Crescisidæ.

D'Orbigny's order the Cellulinés is practically the same as the Cheilostomata, for the Myriozoumidæ are the only *Centrifuginés* which are unanimously regarded as Cheilostomes. His *Centrifuginés* therefore included almost all the Cyclostomata, but unfortunately he scattered among its families many Ctenostomata and Palæozoic Bryozoa. Thus *Fenestella*, *Ichthyorachis*, *Penniretepora*, and *Polypora* were all included in the Sparsidæ; the Silurian *Omniretepora* was placed among the Crescisidæ, and the Ctenostomata *Amathia*, *Serialaria*, *Valkeria*, etc., in the Serialaridæ.

Many, therefore, of d'Orbigny's families have been regarded as so artificial that the whole scheme has been often rejected without recognition of its large measure of truth.

D'Orbigny's first suborder, the *C. Radicellés*, has to be abandoned, as it included two distinct families allied only by the method of attachment; the Serialaridæ are Ctenostomes and the Crisidæ are Busk's Cyclostomata Articulata.

The *C. Empâtés* are the Cyclostomata Inarticulata of Busk; but this suborder of d'Orbigny's includes many Palæozoic genera which have to be removed. Of its four sections the *Operculés* includes a family of Cheilostomata or a group intermediate between Cyclostomata and Cheilostomata. The two sections, *Fasciculinés* and *Tubulinés*, exclusive of various Palæozoic genera are the Cyclostomata Inarticulata, and the *Foraminés* practically represent the Cretaceous Trepostomata.

D'Orbigny's Orders and most of his suborders are therefore still recognized as natural groups.

The majority of his families of Cyclostomata are also natural, though they require amendment in accordance with fifty-six years further knowledge. In spite, however, of the large amount of truth in the classification, it has not been widely adopted. Its neglect has probably been largely due to the fact that it was unnecessarily complex for those who had to deal with the comparatively few Cyclostomata of existing seas. The members of that fauna can be referred to a few widely separated families, and suborders are of little practical convenience.

Von Hagenow, unfortunately for his work, was unable to use d'Orbigny's classification, since he published his monograph on the Bryozoa of the Maastricht Limestone in 1851, and before d'Orbigny's revised classification had been issued. Von Hagenow divided the fossil Bryozoa into four groups, the names and approximate equivalents of which are given in the following table. Unfortunately he made no attempt to divide his groups into families.

Tubuliporina = the Cyclostomata Tubulata.
Cerioporina = the Trepostomata and Cancellata.
Salpingina (for the two genera *Escharites* and *Inversaria*) = Eleidæ.
Urceolata = Cheilostomata.

The next important contribution was by Busk in his "Monograph of the Fossil Polyzoa of the Crag" (London, 1859). This Pliocene fauna included seventeen genera of Cyclostomata, which he distributed among six families; but in an important synoptical arrangement of the Cyclostomata (*op. cit.* p. 91) he included thirty genera, which were apparently all that he admitted, in spite of d'Orbigny, as valid. He remarked that for this Order "our principal reliance in the distinction of genera and species must be placed on the general form of the polyzoary [zoarium], and the mutual relations of the cells." He ignored important structural differences in the zoœcia, and his six families of Inarticulate Cyclostomata are therefore mostly artificial groups. Thus he placed *Diastopora* in a different family from *Alecto* (*Stomatopora*) and *Mesenteripora*, and in the same family as *Patinella*, *Discoporella*, and *Defrancia*.

Busk must have modified his views while the monograph was in course of publication, for in the table on p. 91 he placed *Alveolaria* in the Cerioporidæ, but in the text he included it in the Theonoidæ.

Busk's arrangement, however, showed in his second subdivision of the Inarticulata his recognition of the need for the separation of the massive genera, the Trepostomata. His scheme is as follows :—

I. Articulatæ	Crisiidæ	*Crisidia* and *Crisia*.
II. Inarticulatæ.		
(*a*) Cellulis distinctis	Idmoneidæ	*Hornera*, *Terebellaria*, *Cricopora*, *Cyrtopora*, *Idmonea*, and *Pustulipora*.
	Tubuliporidæ	*Mesenteripora*, *Tubulipora*, and *Alecto*.
	Diastoporidæ	*Diastopora*, *Patinella*, *Discoporella*, and *Defrancia*.
(*b*) Cellulis indistinctis	Cerioporidæ	*Fungella*, *Heteropora*, *Heteroporella*, *Stellipora*, *Neuropora*, and *Spiropora*.
	Theonoidæ	*Alveolaria*, *Fascicularia*, *Theonoa*, and *Lopholepis*.
	Frondiporidæ	*Frondipora*, *Truncatula*, *Distichopora*, and *Plethopora*.

Busk's separation of Articulata has been widely retained, rather as a matter of convenience ; and, as Waters remarks, the division is of no special value.

F. A. Smitt in several papers on the Cyclostomata adopted a classification based on a combination of the views of Busk and d'Orbigny, and he gave Latin forms—Tubulinea and Fasciculinea—to two of d'Orbigny's names. Smitt's classification may be illustrated by the arrangement followed in his "Bryozoa marina in regionibus arcticis et borealibus viventia." He subdivided the Cyclostomata as follows :—[1]

Suborder 1. Radicellata, d'Orb.		Fam. 1. Crisieæ.
,, 2. Incrustata, d'Orb.		
	Section *a*, Tubulinea, d'Orb.	,, 2. Diastoporidæ.
		,, 3. Tubuliporidæ (including *Idmonea* and *Proboscina* as subgenera of *Tubulipora*).
		,, 4. Horneridæ.
		,, 5. Lichenoporidæ.
	Section *b*, Fasciculinea, d'Orb.	,, 6. Frondiporidæ.
		,, 7. Corymboporidæ.
		,, 8. Defrancieæ.

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[1] Öfvers. k. Vet.-Akad. Förh. 1867, vol. xxiv. pp. 444–7.

In 1875 Busk issued his "Catalogue of the Cyclostomatous Polyzoa in the Collection of the British Museum," which served for years afterwards as the standard classification of recent Cyclostomata. It was in many respects a great improvement on his arrangement of 1859, but attached probably undue weight to the mode of growth. It included only seventeen genera, and the classification of this small fauna was a comparatively easy task. His scheme was—

I. Articulata	Crisiidæ	*Crisia* and *Crisidia*.
II. Inarticulata.		
(*a*) Erectæ	Idmoneidæ	*Idmonea*, *Hornera*, *Retihornera*, and *Pustulopora*.
(*b*) Adnatæ	Tubuliporidæ	*Alecto* and *Tubulipora*.
	Diastoporidæ	*Diastopora* and *Mesenteripora*.
	Discoporellidæ	*Discoporella*, *Tennysonia*, *Radiopora*, *Domopora*, and *Defranceia*.
	Frondiporidæ	*Fasciculipora* and *Frondipora*.

In 1880 Hincks published his monograph on "the British Marine Polyzoa," a fauna, however, with so few Cyclostomata that it gave no adequate materials for a satisfactory classification. It included four families, of which two contained one genus each, and the total number of genera was only nine. He separated the articulate and inarticulate members into two groups, for which he adopted d'Orbigny's names of Radicellata and Incrustata. Hincks' treatment of the specific relations of living and fossil species was often unsatisfactory, and the most important contribution he then made to the classification of Cyclostomata was the separation of *Hornera* from the Idmoneidæ, as a new family, the Horneridæ.

In 1881 Dr. Hermann Hamm prepared a generic revision of the Maastricht Bryozoa, and his classification, though severely criticized by Waters, made several valuable contributions to the nomenclature of the group. He divided the Maastricht Cyclostomata into Busk's divisions—the Articulata (the Crisiidæ) and the Inarticulata; the latter he subdivided into three sections. The Tubuliporina comprise five families, the Diastoporidea, the Tubuliporidea, and the Idmoneidea, each of Busk as emended by von Reuss; in addition Hamm founded two new and useful families, the Spiroclausidea and the Osculiporidea. His second section, the Cerioporina, comprised two families, the Cerioporidea and the Radioporidea; and his third section, the Stigmatoporina, included some forms with a central bundle of cylindrical tubes surrounded by a layer composed of the expanded distal ends of the zoœcia; the genera included here were *Cyrtopora*, *Stigmatopora*, a new genus founded from some species of *Pustulipora*, and two species of *Meliceritites*.

This third group, though accepted by Pergens, appears to be useless; but the main lines of Hamm's arrangement of the other groups seem to me a decided advance; thus his Cerioporina was the first step towards the collection into one Order of the massive Bryozoa composed of closely packed tubular zoœcia, and with the crowded apertures, sometimes supplemented by smaller openings, occupying almost the whole surface of the zoarium. The foundation of this section was a partial recognition of the division subsequently named the Rectangulata and the Trepostomata. Hamm, however, included in this section some Bryozoa, such as *Fasciculipora* and *Filifascigera*, which should go with genera which he placed in his Tubuliporina.

The year 1887 was important in the history of the Cyclostomata owing to the publications of MacGillivray, Marsson, Meunier & Pergens, and Waters. MacGillivray[1] then published his Catalogue of the Marine Polyzoa of Victoria, and in it founded four new genera of Cyclostomata; he practically accepted Busk's classification of 1875, and retained it also in his important monograph of the Cainozoic fossil Bryozoa of Victoria in 1895.[2] He accepted the division into Articulata and Inarticulata, and divided the latter among four families—the Idmoniidæ, from which he excluded *Entalophora* (which Busk had placed in it under the name *Pustulopora*), the Tubuliporidæ, including *Entalophora* and *Tecticavea*; the Lichenoporidæ (which in 1887 he called Discoporellidæ), including *Heteropora* and *Discofascigera*; and the Frondiporidæ, including *Supercytis*, *Fasciculipora*, and a species which he referred to *Discotubigera*. Unfortunately MacGillivray died before the completion of his monograph, and the section on the Cyclostomata was left very imperfect.

In 1887 also appeared Marsson's important monograph on the varied Bryozoa of the Rügen Chalk. He had no Articulata to deal with, and divided the rest into two groups—the Metopoporina, including the Ceidea and Eleidæ, which, in spite of their trumpet-shaped zoœcia and their contracted mouths giving them some resemblance to the Cheilostomata, he wisely left in the Cyclostomata. The remainder of the Cyclostomata Marsson grouped as the Solenoporina, characterized by the aperture occupying the whole end of the zoœcium, and with the distal ends of the zoœcia only slightly or not at all separated. This second suborder includes the great majority of Cyclostomata, and he distributed them among six families.

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[1] P. H. MacGillivray. Proc. R. Soc. Victoria, vol. xxiii. pp. 187–224. Issued February, 1887.

[2] P. H. MacGillivray. A Monograph of the Tertiary Polyzoa of Victoria: Trans. R. Soc. Vict., 1895, vol. iv.

1. Diastoporidea, ranging from *Stomatopora* to *Diastopora*, with the addition of three dissimilar genera, viz., *Cryptoglena*, which has the moniliform walls and the difference between the proximal and distal ends of the zoœcia so common in the Trepostomata; *Cavarinella*, a hollow-stemmed ally of *Sparsicavea*; and *Cavaria*, a Petaloporid.

2. Entalophoridea, represented by nine genera; he included *Sparsicavea*, and also *Heteropora*, as he used that name as a synonym of *Petalopora*.

3. Idmonidea—with thirteen genera—is essentially the same as Busk's family, as it includes *Crisina* (i.e. *Idmonea* auctt.) and *Hornera*, with the addition of *Reticulipora*—using that genus for *Retecrisina*, and not for the very dissimilar type species, which is Jurassic.

4. Osculiporidea—for *Osculipora* of d'Orbigny and *Desmepora*, Lonsd.

5. Radioporidea—for seven genera, including a natural series, *Discocavea*, *Domopora*, and *Radiopora*, but united with the fasciculate genera *Lopholepis* and *Discocytis* and the Theonid *Phyllofrancia*.

6. Cerioporidea—*Ceriopora* and the quite distinct *Discosparsa*.

These families, it will be seen, are not very satisfactory groupings, but each of them contains a nucleus of allied forms with others of very different structures, which are well shown in Marsson's excellent sections and drawings.

In 1887 Pergens & Meunier described the Danian Bryozoa of Faxoe,[1] including thirty-eight species and twenty genera of

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[1] E. Pergens & A. Meunier. "La Faune des Bryozoaires garumniens de Faxe": Ann. Soc. malac. Belgique, vol. xxi., Mém. pp. 187–242, pls. ix–xiii.

Cyclostomata, which they divided among nine families. Their arrangement is interesting for the considerable increase in the number of families. Although they included *Escharites* and *Sparsicavea* in the Entalophoridæ they failed to accept the Horneridæ.

Stomatoporidæ	...	*Stomatopora.*
Diastoporidæ	...	*Diastopora.*
Entalophoridæ	...	*Entalophora*, *Bidiastopora*, *Escharites*, *Spiropora*, and *Sparsicavea.*
Idmoneidæ ...	. .	*Idmonea*, *Reptotubigera*, *Hornera*, and *Filisparsa.*
Tubigeridæ ...	...	*Bisidmonea* and *Tuberculipora.*
Fasciporidæ	...	*Fungella* and *Supercytis.*
Fasciculiporidæ	...	*Cyrtopora* and *Truncatula.*
Heteroporidæ	...	*Heteropora* (= *Reptomulticava*).
Lichenoporidæ	...	*Radiopora* (= *Bicavea*) and *Lichenopora* (syn. *Actinopora* and *Domopora*).

The year 1887 was also marked by Mr. Waters' one constructive suggestion towards the classification of the Cyclostomata.[1] In an account of the Cainozoic Cyclostomata from New Zealand he proposed to divide the Cyclostomata "into two subdivisions, namely, first the *Parallelata*, or those in which the surface of the zoarium is to a considerable extent formed of the lateral walls of the zoœcia, of which *Crisia*, *Entalophora*, *Diastopora*, and *Tubulipora* may be taken as types; and secondly, the *Rectangulata*, or those in which the zoœcia or cancelli open for the most part at right angles to the axis or surface of the zoarium or sub-colony, of which *Heteropora*, *Lichenopora*, etc., may be taken as typical." This proposal followed the lead by Hamm, whose Cerioporina, with its zoœcia "more or less rectangular to the upper surface," foreshadowed the Rectangulata, while Hamm's Tubuliporina necessarily all have the sides of the zooecia widely exposed.

The proposal by Waters to found the primary division of the Cyclostomata on the characters of the zoarium is significant, as he has generally attached little systematic value to the zoarium. In the same year he remarked[1] that "the mode of growth in other divisions has been clearly shown to have secondary importance, and the same thing may to a certain extent be seen here."

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[1] A.W.Waters. Quart. Journ. Geol. Soc. 1887, vol. xliii. p. 337. Mr. Waters has written many papers on the Cyclostomata, but does not group the genera into families; the same course was adopted by Mr. Louis Calvet in describing the fifty-three species of Cyclostomata collected by the "Travailleur" and "Talisman." Expéd. Sci. du "Travailleur" et du "Talisman," Années 1880–3, Annélides, etc., pp. 356–495, pls. xxvi–xxx.

If Mr. Waters had developed this line of classification, his two divisions would probably have been accepted and have proved of material service. But he almost at once changed ground, and later on the same year based his two divisions on different and inconsistent characters. Thus he says, "In the Quart. Journ. Geol. Soc. vol. xliii. p. 337, I proposed to divide the Cyclostomata into Parallelata, in which there are no cancelli, and Rectangulata, in which the openings of the cancelli occur between the zoœcial tubes." This basis for the two divisions was published in October, 1887,[2] and may therefore be regarded as intended to replace his original proposal of August in the same year. The use of cancelli as the essential character of his subdivisions was inconsistent with a classification according to the grouping of the zoœcia. Cancelli are not present in all rectangulate Cyclostomata, and they are not absent from all those with a parallel growth. Hence the name Rectangulata is unsuitable to the group with the modified definition.

Ulrich, however, in 1890, founded the Trepostomata, based on practically the same principle as that adopted by Hamm and by Waters in August, 1887; and as there is no uncertainty as to the meaning of Trepostomata, and Ulrich used both the zoarial arrangement and the zoœcial modification consequent on it, his name was followed in the two previous volumes of the catalogues of the Mesozoic Bryozoa.

As a last example of the successive classifications of the Cyclostomata may be quoted Ulrich's of 1900.[3]

Crisiidæ ...	*Crisia.*
Diastoporidæ ...	*Stomatopora*, *Berenicea*, *Discosparsa*, *Diastopora*, and *Bidiastopora*, with the Palæozoic genera *Diastoporina*, *Hederella*, *Hernodia*, and *Reptaria*.
Idmoneidæ ...	*Idmonea*, *Bisidmonea*, *Filisparsa*, *Filicavea*, *Filicrisina*, *Hornera*, *Reticulipora*, *Retecava*, *Bicrisina*, *Sulcocava*, and the Ordovician *Protocrisina*.

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[1] A. W. Waters. "Bryozoa from New South Wales, North Australia, etc.," pt. iii: Ann. Mag. Nat. Hist. 1887, ser. 5, vol. xx. p. 253.

[2] *Ibid.*

[3] In Zittel-Eastman. Textbook of Palæontology, 1900, vol. i. pp. 260–71.

Entalophoridæ	*Entalophora*, *Spiropora*, *Peripora*, ? *Clausa*, ? *Petalopora*, and the Palæozoic *Mitroclema*, *Diploclema*, and *Clonopora*.
Fasciporidæ ...	*Fascipora*, *Semifascipora*, *Conotubigera*, and *Serictubigera*.
Fascigeridæ ...	*Filifascigera*, *Reptofascigera*, *Theonoa*, *Fasciculipora*, *Frondipora*, *Unicytis*, *Osculipora*, *Truncatula*, *Desmeopora*, *Cyrtopora*, and *Plethopora*.
Lichenoporidæ	*Discocytis*, *Apsendesia*, *Lichenopora*, *Stellocavea*, and ? *Multicavea*.
Cerioporidæ ...	*Ceriopora*, *Heteropora*, *Heteroporella*, ? *Ditaxia*, *Chilopora*, *Neuropora*, and *Acanthopora*.
? Ceramoporidæ...	Ten Palæozoic genera, viz., *Ceramopora*, *Ceramoporella*, *Crepipora*, *Anolotichia*, *Diamesopora*, *Ceramophylla*, *Chiliporella*, *Bythotrypa*, *Scenellopora*, and *Spatiopora*.
? Fistuliporidæ ...	Eleven Palæozoic genera, viz., *Fistulipora*, *Cyclotrypa*, *Eridopora*, *Chilotrypa*, *Meekopora*, *Strotopora*, *Lichenotrypa*, *Buskopora*, *Selenopora*, *Pinacotrypa*, and ? *Botryllopora*.
? Ceidæ	*Semicea*, *Cea*, and *Filicea*.
? Melicerititidæ ...	*Semielea*, *Elea*, and *Meliceritites*.

The foregoing sketch of the classifications of the Cyclostomata shows that this group is the subject of unusually complete divergence of opinion as to the number of subdivisions required and as to their respective affinities. And some authors seem to regard a satisfactory classification as so unattainable that they make no attempt to collect the genera into families. This unprogressive policy is, however, useless for the description of large fossil faunas.

The general trend of opinion may be gathered from the previous summary of fifty years' progress, which shows the growing recognition for a more complex classification than is necessary for the living fauna. Palæontologists recognize the need for a considerable number of families. Thus Meunier & Pergens in 1887 adopted nine, and Ulrich in 1900 adopted twelve.

In this Catalogue I feel bound to accept fourteen families of Cyclostomata in addition to three of Trepostomata.

The classification of the Cyclostomata is simplified by the separation of the Trepostomata, and it seems to be now generally recognized that the latter form a natural group. Ulrich's foundation of that Order satisfied a want that had been felt even as early as by Busk in 1859.

The parallel growth of the zoœcia, though the most conspicuous character of the Trepostomata, would, however, alone be inadequate.

The taxonomic value amongst Bryozoa of the arrangement of the zoœcia in masses of parallel, crowded tubes has been often discussed. The distinction was accepted as of generic value by Lamarck in 1816, when he separated *Alcyonella* from *Plumatella*; for the former genus, as illustrated by the excellent figure of *Alcyonella fungosa* (Pall.) by Allman,[1] is characterized by its zoarium consisting of crowded polygonal tubes, which rise vertically from a series of creeping horizontal tubes. Its structure is that of the Rectangulata.

Zoologists who attached little value to the characters of the zoarium early maintained that *Alcyonella* was only an individual variation of *Plumatella*, a view that has been urged by Raspail (1828), Ehrenberg (1831), and Siebold (1848). Raspail[2] defended this view in the famous memoir "Histoire Naturelle de l'Alcyonelle fluviatile," wherein he urged that all the fresh-water Bryozoa then known were varieties of one species. The validity of the two genera was upheld by Allman (1848), as the two forms maintain their distinctions even when growing together under precisely the same conditions, as the differences between them are always constant, and as their geographical distribution is different, *Plumatella*, for example, being abundant in Ireland, where *Alcyonella* has not been found. Dr. Harmer,[3] however, following Kraepelin, has abandoned *Alcyonella* and speaks of Alcyonelloid forms of *Plumatella*, and he remarks[4] that the occasional lax growth of an *Alcyonella* causes it to resemble *Plumatella*.

Whatever conclusion may be accepted as to the value of these two genera, they illustrate the fact that closely allied forms may have strikingly different modes of growth, and show that the tendency of the zoœcia to arrange themselves in crowded vertical series is not of great systematic value throughout the whole group of Bryozoa.

The differences between the proximal and distal ends of the zoœcia, combined with their parallel growth into massive zoaria, afford, however, adequate grounds for the separation of the Trepostomata.

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[1] G. J. Allman. "A Monograph of the Fresh Water Polyzoa": Ray Soc. 1856, pl. iii. fig. 4.

[2] Raspail. Mém. Soc. Hist. Nat. Paris, 1828, vol. iv. pp. 75–165.

[3] S. F. Harmer. Polyzoa: Cambridge Natural History, 1896, p. 494.

[4] *Op. cit.* p. 505.

The reference of the Mesozoic Cerioporidæ and their allies to the Trepostomata has not been accepted by Ulrich, who in 1900 included them in the Cyclostomata. But if *Ceriopora*, *Heteropora*, etc., are to be excluded from the Trepostomata, I fail to see any valid characters sufficient for the retention of that Order. Thus, Figs. 5–10 of some sections, reproduced from the works of Ulrich and Bassler, show how closely some Palæozoic genera agree in structure with Mesozoic Bryozoa.

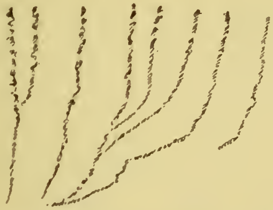

Fig. 5.—*Ceramopora niagarensis*, Bassler. Silurian—Rochester Shale: Rochester, N.Y. Vertical tangential section; × 8. (After Bassler.)

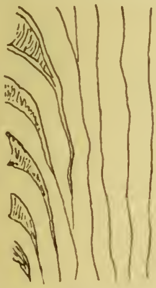

Fig. 6.—*Eridotrypa nodulosa*, Bassler. Silurian—Rochester Shale: Lockport, N.Y. Vertical tangential section; × 20. (After Bassler.)

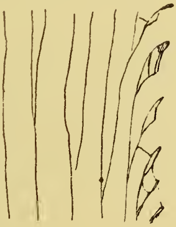

Fig. 7.—*Trematopora debilis*, Ulrich. Ordovician — Trenton Group: Alexander Co., Ill. Vertical section of half a stem; × 18. (After Ulrich.)

Fig. 5 shows that the walls of *Ceramopora*, though moniliform, may remain quite thin to the surface of the zoarium. Fig. 6, of *Eridotrypa*, and Fig. 7, of *Trematopora*, illustrate Palæozoic genera with long tubular zoœcia, of which the apertures are separated by a thickening of the wall of the zoarium.

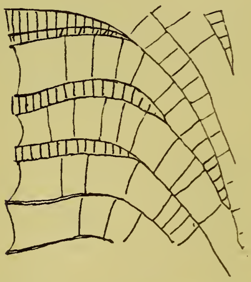

FIG. 8.—*Callopora elegantula*, Hall. Silurian—Niagara Group: Lockport, N.Y. Tangential section; × 18. (After Ulrich.)

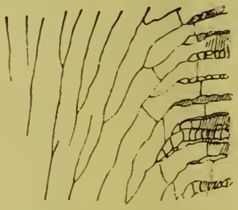

FIG. 9.—*Heterotrypa inflecta*, Ulrich. Ordovician—Cincinnati Group: Cincinnati, O. Vertical section; × 12. (Reduced from Ulrich.)

Fig. 8, of *Callopora*, with its abundant diaphragms and narrow mesopores, has essentially the same structure as some Jurassic species (cf. *Heteropora conifera*, B.M. Cat. Jur. Bry. p. 205, fig. 19*a*); *Heterotrypa* (Fig. 9), with its rare diaphragms and moniliform walls, agrees with the structures of *Ceriopora farringdonensis*, Greg., and *Ceriopora tuberosa* (Röm.), shown in Figs. 42 and 45 of this volume; while *Atactoporella* (Fig. 10) resembles in its multilamellar zoarium the structure of *Multicrescis laminata* (Greg.), B.M. Cat. Jur. Bry. pl. xi. fig. 3*b*, or the *Multicrescis tuberosa* (Röm.) of Fig. 54 of this volume.

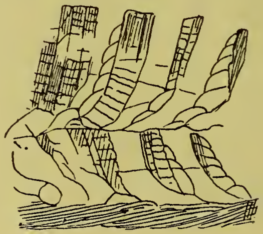

FIG. 10.—*Atactoporella ortoni*, Nicholson. Ordovician—Cincinnati Group: Cincinnati, O. Vertical section of a specimen consisting of two layers of cells; × 35. (After Ulrich.)

It seems inevitable that either some Mesozoic genera must be accepted as Trepostomata or that Order must be redefined.

The Order Cyclostomata becomes more homogeneous when the Trepostomata are excluded, but it is still so large that it is advisable to arrange the families into suborders.

It is possible to frame several working classifications of the Cyclostomata, each based on different assumptions as to the character of primary importance. Thus the nature of the zoarium, the general shape of the zoœcium, the linear, radial, or irregular arrangement of the zoœcia, and the solid or cancellous structure of the skeleton, might each be used as the primary systematic character. The final test between such classifications is the historical. When the many wide gaps in the succession of the Mesozoic Bryozoa are filled, we shall know which were the ancestral forms, and shall be able to arrange the genera in the order of their descent.

Any classification must at present be experimental, and the test by which it must ultimately be judged is its agreement with the actual facts of succession and descent shown by the geological distribution of the genera. The historical test is the final test in phylogeny for organisms with sufficient skeletons to give abundant fossils.

No doubt the palæontological record of the Bryozoa is so imperfect that it will be long before this method can be fully used. But every effort to adopt it calls attention to the gaps in the evidence, and thus tends to remove them. In the meantime we must be prepared for tentative suggestions, and progress will be achieved by those who are ready to propose reforms, even though they thereby risk mistakes.

In proposing changes in the classification of Cyclostomata in 1896 and 1899, I was quite prepared to modify the schemes suggested with further knowledge; but some definite classification seemed necessary in order to demonstrate the relation of the successive Cyclostomatous faunas of the Mesozoic and Cainozoic eras. The classification may be based on zoarial or zoœcial characters, or on both. The last of these three courses seems to me the best, the zoœcial character being generally used for the suborders and the zoarial for the families and genera.

The Cyclostomata seem to have three chief types of zoœcia—

(*a*) Simple, tubular, monomorphic zoœcia, with solid walls.

(*b*) Zoœcia monomorphic, having walls perforated by cavities—the cancelli.

(*c*) Zoœcia dimorphic, one set being aborted to form supporting elements in the zoarium.

Accordingly, in 1896 in the Museum Catalogue of the Jurassic Bryozoa, and in 1899 in the first volume of the present Catalogue, I divided the Cyclostomata into three sections, the Tubulata, Cancellata, and Dactylethrata, each characterized by one of the three types of zoœcia.

The Tubulata seem to form a homogeneous group. The Eleidæ is its most aberrant family. The other families can be divided into two series: those in which the zoœcia are combined as units; and those in which they occur in bundles, and the structure is therefore fasciculate. The opinion that the fasciculate arrangement of the zoœcia is an important taxonomic character has had the support of Mr. A. W. Waters,[1] and has been widely accepted ever since d'Orbigny founded his division, the *Fasciculinés*.

The Cancellata are characterized by their cancelli, whose nature has been discussed on pp. xxi–iv. Mr. Waters in 1884 remarked that the existence of cancelli "does so far seem a character of great value, and these seem to indicate a different origin of the zoœcial tube."[2]

The Dactylethrata prove to be a less coherent group than I expected in 1896; but the isolation of the families is probably due to their specialized structure, for the presence of the supporting elements led to the development of large zoaria, which diverged at once along very different lines.

The following is a synopsis of the classification proposed in the two previous Catalogues, as expanded to include the remainder of the Cretaceous Cyclostomata, which are described in this volume:—

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[1] A. W. Waters. Foss. Cycl. Australia: Quart. Journ. Geol. Soc. 1884, vol. xl. p. 678.

[2] A. W. Waters. *Ibid.*

Suborder TUBULATA.—Zoœcia simple and tubular. Monomorphic.

Section A.—Apertures scattered or in lines, and not in groups.

Fam. *Crisiidæ.*—Zoarium usually articulate, with chitinous joints, attached by radical tubes.

Fam. *Diastoporidæ.*—Zoarium linear or in bands or sheets. Sheets adnate or erect, and occasionally superposed.

Fam. *Idmoniidæ.*—Zoarium adnate or erect. Apertures only on the obverse face, and arranged in transverse or divergent rows.

Fam. *Entalophoridæ.*—Zoarium erect and dendroid. Apertures occurring all around the stem.

Fam. *Eleidæ.*—Apertures sub-terminal or lateral. Avicularia and spines present.

Section B.—Apertures in crowded bands.

Fam. *Theonoidæ.*—Zoarium adnate or erect. Apertures confined to crowded bands along raised ridges or the edges of the fronds.

Section C.—Apertures in groups at the ends of fasciculi.

Fam. *Fascigeridæ.*—Zoarium fasciculate; fasciculi free for most of their length.

Fam. *Osculiporidæ.* — Zoarium fasciculate; fasciculi closely attached and the apertures on raised processes.

Suborder CANCELLATA.—Zoœcia with cancelli.

Fam. *Petaloporidæ.*—Zoarium erect and branched. Apertures on all sides of the stem.

Fam. *Horneridæ.*—Zoarium erect and branched. Apertures only on the obverse side.

Fam. *Desmeporidæ.* Zoarium fasciculate; apertures in groups on raised processes.

Suborder DACTYLETHRATA.—Zoarium provided with dactylethræ.

Fam. *Reticuliporidæ.*—Zoarium of compressed branches; apertures confined to obverse parts of branches.

Fam. *Terebellariidæ.*—Dactylethræ in crowded bands around the stems.

Fam. *Clausidæ.*—Zoarium erect or adnate. Zoœcia distributed uniformly and separated by circles of dactylethræ.

THE GEOLOGICAL VALUE OF THE BRYOZOA.

The final test of the classification of Bryozoa depends on materials to be collected by the stratigraphical geologist, but he will probably find his trouble repaid by the geological value of the Bryozoa. The view was once prevalent that their specific life was so prolonged that they would be of no help in zonal palæontology. This idea was natural amongst pioneers in the description of this group, such as Lamouroux, since they were naturally impressed by the few most conspicuous features and practically ignored anything less striking than characters of generic value. The specific characters were duly recognized by d'Orbigny, von Hagenow, von Reuss, and most of their contemporaries; but in later years there has been an attempt to return to the pre-d'Orbignyan methods. Thus Hincks, by ignoring differences between fossil and recent specimens, often included Cretaceous and living Bryozoa in the same species. Mr. Waters is now the chief upholder of this method, and he has included some Carboniferous Bryozoa in living species.

In recent years the stratigraphical value of the Bryozoa has, however, been widely recognized. In the first volume of this Catalogue I went much further than most students of Bryozoa at that date (1899), but apparently I did not go far enough. Thus I suggested, though doubtfully, placing a note of interrogation before the name in the synonymy, that the Neocomian *Berenicea flabelliformis* and the Senonian *B. gracilis* of d'Orbigny might be the same species.[1] M. Canu[2] emphatically rejects this view as a simple blunder, and separates the two forms specifically. After another ten years work on the Bryozoa I am disposed to regard them as better zonal guides, and to look with even greater suspicion on the identity of Bryozoa from widely separated geological horizons than I was in 1899.

Of course it may not be possible to separate specifically small fragments or imperfectly preserved specimens of Bryozoa any more than it is with fragments of other groups of animals; but that is no reason why Cretaceous and living *Tholoporæ*, for example, should be placed in the same species because they both possess the same generic characters.

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[1] B.M. Cat. Cret. Bry. vol. i. p. 73.

[2] Canu, 1902. Bry. foss., I. Coll. Campiche: Bull. Soc. géol. Fr. ser. 4, vol. ii. p. 10.

The recent careful zonal collecting in the English Chalk has shown that the Bryozoa are often remarkably restricted in their range and may be especially useful as zonal fossils. Thus Dr. Rowe has shown that *Bicavea rotaformis* is confined to a narrow band just above the base of the *Holaster planus* zone. The two recent Geological Survey Memoirs on the country around Andover and around Henley both show that the Bryozoa are practically confined to a few horizons, on which, however, they appear to be common. Thus near Andover[1] there are no Bryozoa recorded in the lists from the Lower Chalk (p. 17) or from the *Holaster planus* zone (pp. 28, 29). There is a list of ten species from the *M. coranguinum* zone (p. 37), identified by Mr. Treacher, but only one of them ranges upward to the zones of *Marsupites* and of *Actinocamax quadratus*. The brachiopods, on the contrary, are more widely distributed and have a longer range.

Again, in the country around Henley,[2] the memoir includes no Bryozoa in its lists from the Lower Chalk (pp. 27, 28) and only four species from the Middle Chalk, but it includes a list of thirty-eight species and varieties determined by Mr. Treacher from the Upper Chalk; most of these species come from the zone of *Micraster cortestudinarium*.

In this list of thirty-eight species, seven are confined to the *Holaster planus* zone, five to the zone of *Micraster cortestudinarium*, and sixteen to the zone of *Micraster coranguinum*. Of the remaining ten species, seven are found both in the *cortestudinarium* and *coranguinum* zones. two pass from the Middle Chalk up to the *coranguinum* zone, and one passes from the Middle Chalk only to the *cortestudinarium* zone.

The belief that the Bryozoa are of little zonal value is due to old and unreliable determinations. Thus Vine prepared a synopsis[3] of the horizons of the species that had been recorded from the Farringdon Sponge Bed. The thirty-five species in his list identified from that bed are distributed among the following horizons:—

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[1] A. J. Jukes-Browne. Partly from Notes by F. J. Bennett and H. J. Osborne White. "The Geology of the Country around Andover." Mem. Geol. Surv. England and Wales. Explanation of Sheet 283. 1908. pp. v + 67, 12 figs.

[2] A. J. Jukes-Browne & H. J. Osborne White. "The Geology of the Country around Henley-on-Thames and Wallingford": Mem. Geol. Surv. England and Wales. Explanation of Sheet 254. 1908. pp. viii + 113, 13 figs.

[3] G. R. Vine. Rep. Cret. Polyz.: Rep. Brit. Assoc. 1890, p. 386.

	Species.
Danian	3
Senonian	9
Turonian	1
Cenomanian	10
Albian	2
Aptian	0
Neocomian	9
Bajocian	1

The age of the bed is generally regarded as Aptian,[1] which is the only division from which no species was recorded. This list, however, does not prove that the Bryozoa are of no stratigraphical value; it merely shows that the determination of the species had followed wrong lines.

The Literature of Cretaceous Bryozoa.[2]

The work on the British Cretaceous Bryozoa is remarkably scanty. A few species were poorly figured by pioneer palæontologists, as in König's "Icones fossilium sectiles" (1825), S. Woodward's "Geology of Norfolk" (1833), and Mantell's "Medals of Creation" (1844). The first British work of permanent value was by Lonsdale, who in 1845 described some Cretaceous Bryozoa from North America, and then in 1849, 1850, and 1851 described, with perhaps excessive detail, a few species from the English Lower Greensand and from the Chalk of Sussex.

In 1846 and 1850 Austen, subsequently known as Godwin-Austen, recorded a few Bryozoa from the Lower Greensand, and David Sharpe, in 1854, described a few species from the same horizon at Farringdon. Then followed an interval of twenty-six years, during which the only addition to the British Cretaceous Bryozoa that requires notice was the late Professor Seeley's description in 1866 of three species from the Red Chalk. In 1880 G. R. Vine, the most voluminous author on the British Cretaceous Bryozoa, began his series of papers, which lasted till 1892. His most important additions to the Cretaceous Bryozoa were descriptions of the faunas of the Cambridge Greensand and the Red Chalk; most of his other papers were in the main compilations of previous records and the identification of English Chalk specimens with previously known Continental species. Meanwhile, in 1883, Keeping had described the Bryozoa from the Lower Greensand of Upware, and Mr. W. Gamble, of Chatham, had made the first part of his important collections of Middle Chalk Bryozoa at Chatham. Many of the species recorded by Vine had been discovered by Gamble.

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[1] See, however, G. W. Lamplugh. "Belemnites of the Farringdon 'Sponge Gravels'": Geol. Mag. 1903, dec. iv. vol. x. pp. 32–4. He holds that the belief that many of the belemnites in these gravels are remanié is without adequate foundation, and assigns a pre-Aptian age to this deposit. He regards it as "probably equivalent to the lowermost portion of the Lower Greensand Series of south-eastern England."

[2] References are given in the Bibliography, pp. 315 et sqq.

In recent years much more attention has been paid to the Chalk Bryozoa, largely inspired by Dr. Rowe's valuable work on the zonal classification of the Chalk, and his recognition of the stratigraphical value of its Bryozoa; and the recent memoirs of the Geological Survey by Mr. Jukes-Browne have included more useful catalogues of Chalk Bryozoa than were formerly possible. Many of these Chalk species were collected and identified by Mr. L. Treacher, and others found by Messrs. Treacher and H. J. Osborne White, while others have been collected by Messrs. Withers & Chatwin, of the Geological Department of the Museum. Mr. W. D. Lang, of the same Department, has contributed a series of valuable papers from 1903 to 1908. Mr. R. M. Brydone described a series of new Cheilostomata from the Trimmingham Chalk in 1906.

The Cretaceous Bryozoa have been most extensively studied in France, where the successive faunas have been described in a valuable series of monographs, including those by Michelin, d'Orbigny, Bucaille, Canu, and Filliozat.

The Swiss fauna has been described by Pictet, de Loriol, and d'Orbigny, and is of interest as containing an older Cretaceous marine fauna than in the regions further north, for the Cretaceous sea reached Switzerland while France, Germany, and the British Isles were still continental.

Germany contains three Cretaceous Bryozoa faunas—Urgonian, Cenomanian, and Senonian, and they have been described in the works of Goldfuss, Koch & Dunker, Römer, von Hagenow, Osswald, von Reuss, Simonowitsch, Vogel, Marsson, and others.

Goldfuss' work was fundamental, as he founded many of the commonest Cretaceous species. To Marsson we owe the important monograph on the Rügen Senonian fauna, which had been inadequately described by von Hagenow.

The Bohemian faunas, of which the Cenomanian is the most interesting, are closely related to those of Germany, and have been described by Römer, von Reuss, Novak, and Počta. Frič has described from the Bohemian Cretaceous the one known fossil referred to the Phylactolæmata.

The Belgian Bryozoa all belong to the Upper Cretaceous (Senonian and Danian), and they are well known through the work of von Hagenow, Beissel, Ubaghs, and Pergens & Meunier.

In the extra-European countries the Cretaceous Bryozoa are still imperfectly known. The Maastrichtian series has yielded an extensive fauna in New Jersey. A few species were described therefrom by Morton and Lonsdale, and it is now well known by the works of Gabb, Horn, and Stuart Weller. From Texas two Cretaceous species have been described by Ulrich.

From Southern Tunis Peron has described a Cretaceous fauna allied to that of Southern France.

The chief Asiatic representatives are from India, and were described by Stoliczka. An Australian species was described by Moore. A few are known from South Africa, and have been described by Mr. W. D. Lang.

It is unfortunate that the existing extra-European Cretaceous Bryozoa are so little known that they afford no adequate evidence as to geographical distribution during the Cretaceous era. The Maastrichtian series, which is so rich in Europe, has contributed the one important fauna in America. Knowledge of the Bryozoa from the Cretaceous of South America, Queensland, and New Zealand would be of much interest.

The Cretaceous Bryozoa Collection.

The British Museum Collection of Cretaceous Bryozoa is large and representative, and has been slowly acquired from many British and Foreign geologists. The basis of the British Collection is the large series of Chalk fossils from the south-east of England in the Mantell, Dixon, and Bowerbank Collections. The magnificent series of Bryozoa from the Middle Chalk of Chatham has been collected by Mr. W. Gamble; the first specimens from that locality in the Museum were presented by him in 1889; larger collections were obtained later by purchase, and other specimens from Chatham were obtained in the Vine Collection. That collection, purchased in 1893 from the executors of G. R. Vine, included a valuable series of Chalk specimens, but its most important were his types from the Red Chalk and the Cambridge Greensand; these fossils are often very fragmentary and poorly preserved, and the interpretation of most of the species would be impossible without access to the original specimens. Other Chalk material has been presented by Dr. H. P. Blackmore, of Salisbury, Dr. W. F. Hume, and Mr. Joseph Wright, of Belfast, from whom the Museum received a small series of Bryozoa from the Irish Chalk.

The Bryozoa of the Red Chalk and of the Cambridge Greensand are well represented in the collection of T. Jesson. Those of the Farringdon sponge gravels, with which the collection is poorly provided, were mainly obtained in the Cunnington, Mantell, and S. Sharp Collections. An interesting but imperfectly preserved collection from the Upper Greensand of the Haldon Hills was bequeathed by William Vicary in 1903.

The most important collection of Foreign Cretaceous Bryozoa is the large Van Breda Collection from the limestones of Maastricht; further material from the same locality has been acquired with the Vine Collection, many specimens of which were identified by Mr. Pergens, and others are in the Busk Collection.

During recent years small representative collections from many important foreign localities have been acquired by purchase and exchange.

Thus the important fauna from the German Neocomian is represented by a collection purchased from Krantz in 1898; others were presented by Professor Credner the same year. A collection of the Senonian Bryozoa from the Loire Valley was bought from Mr. F. H. Butler in 1898. Specimens from New Jersey were obtained by purchase from Mr. Ulrich in 1898–9. From the Chalk of Rügen a vast collection has been obtained from Mrs. Agnes Laur, of Dresden, by successive purchases in 1899 and later years, but of this series only part of the first collection has been incorporated in the Catalogue.

The chief desiderata of the collection are the faunas from the Crimea, Southern Sweden, the Charente and Charente-Inférieure in France, Algeria and Southern Tunis, Switzerland, and the Danian of Ciply.

The chief collections are as follows:—

H. P. Blackmore. Presented 1897.
J. S. Bowerbank. Purchased 1865.
G. Busk. Presented by Miss Busk 1899.
F. H. Butler. Purchased in various years, especially 1898.
W. Cunnington. Purchased 1849, 1861, 1875. Presented 1859.
F. Dixon. Purchased from Executors 1850.
W. Gamble. Collection presented in 1889, and two collections purchased 1893 and 1898.
J. S. Gardner. Purchased 1876–86.
T. Jesson. Purchased 1888, 1891, 1892, 1894.
F. Krantz. Purchased 1898.
A. Laur. Purchased 1899 et sqq.
G. A. Mantell. Purchased 1839 and 1853.
E. O. Ulrich. Purchased 1898–9.
J. G. S. van Breda. Purchased from Executors 1871.
Wm. Vicary. Bequeathed 1903.
G. R. Vine. Purchased from Executors 1893.
Joseph Wright. Presented 1897.

SYSTEMATIC DESCRIPTION.

GROUP BRYOZOA, Ehrenberg, 1831.

CLASS ECTOPROCTA, Nitsche.

SUBCLASS GYMNOLÆMATA, Allman.

Order CYCLOSTOMATA, Busk.[1]

Suborder TUBULATA, Gregory.

Family CRISIIDÆ.

DIAGNOSIS.

Cyclostomata Tubulata with simple zoœcia which grow into a dendroid articulated zoarium, attached by radical tubes. The zoœcia are uniserial or biserial, and the branches are divided into calcareous segments separated by chitinous joints. The ovicells or gonœcia are piriform, or irregularly piriform.

CRISIA, Lamouroux, 1816.

[Hist. Polyp. Corall. flex. p. 136.]

SYNONYMS.

Sertularia, pars, Linnæus, 1758; Esper, 1788, etc.
Cellularia, pars, Pallas, 1766; Bruguière, 1789, etc.
Cellaria, pars, Ellis & Solander, 1786; Lamarck, 1816; de Blainville, 1834.
Crisia, pars, Lamouroux, 1816, 1821; Fleming, 1828; de Blainville, 1834; Milne-Edwards, 1838; Johnston, 1838; d'Orbigny, 1854; Smitt, 1864; Busk, 1875; Macgillivray, 1880; Norman, 1869; Harmer, 1891, etc.
Falcaria, pars, Oken, 1815–16; de Blainville, 1834.
Eucratea, pars, Hammer, in Lamouroux, 1821; Fleming, 1828; Esper, 1829.
Unicellaria, de Blainville, 1834.
Crisidia, Johnston, 1847; Sars, 1853; d'Orbigny, 1853; Heller, 1867; Busk, 1875.
Filicrisia, d'Orbigny, 1853.

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[1] G. Busk & M. J. Macgillivray: "Narrative of the Voyage of H.M.S. 'Rattlesnake,'" 1852, vol. i., App. p. 346. "The first suborder, having a round simple opening to the cell, is here termed the Cyclostomata."

DIAGNOSIS.

Crisiidæ with the zoœcia uniserial or biserial.

TYPE SPECIES.

Crisia eburnea (L.). Recent: European seas.

This genus is well known among recent marine Bryozoa, and is represented in the existing British fauna, according to Dr. Harmer's monograph,[1] by six species. It has been recorded fossil from various Cainozoic horizons, as by Busk[2] doubtfully from the Pliocene, and by von Reuss[3] from the Oligocene and Miocene of Austria. Its range has been extended to the Cretaceous by d'Orbigny and Pergens. Pergens has referred a series of small isolated cyclostomatous tubes from the Belgian Cretaceous to this genus. Judging from his figures the correctness of his identification appears to be probable. Owing to the articulate structure of the zoarium, *Crisiæ* are not likely to be well preserved as fossils, for the zoœcia will naturally fall apart by the decay of the chitinous joints. The British Museum collection includes no Cretaceous representatives of the genus.

The *Unicrisia* of d'Orbigny,[4] founded on a French Senonian species, is a doubtful member of the Crisiidæ; the fragment figured by d'Orbigny (*op. cit.* pl. 734, figs. 13, 14) does not show that the zoarium was articulated.

Mr. Waters has identified[5] the *Crisina unipora* of d'Orbigny as a *Crisia*. He has figured at the same time a Bryozoan from Curdies Creek in South-Eastern Australia, which is probably of Miocene age, as a representative of the French Cretaceous species. His figure shows a Bryozoan with thick, irregular, sinuous branches, which are very different from the straight narrow branches of *Crisina unipora*.[1] This instance illustrates the inconvenience of uniting in the same species Australian Miocene and European Cretaceous Bryozoa, in spite of marked differences between them. Among other disadvantages this system has led to the impression that the Australian Cainozoic deposits are on a lower horizon than they appear to be.

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[1] S. F. Harmer. "On the British Species of *Crisia*": Quart. Journ. Micro. Sci. vol. xxxii. (1891), pp. 127–81, pl. xii.

[2] G. Busk. Crag Polyz. p. 93.

[3] *Crisia edwardsi*, *C. hoernesi*, and *C. haueri*, A. E. von Reuss. Foss. Polyp. Wien. Tertiärb.: Naturw. Abh. vol. ii. pp. 53, 54, pl. vii, figs. 20–4. Also in Fauna deut. Oberoligoc. ii.: Sitz. k. Akad. Wiss. Wien, vol. l. Abt. i. (1865), p. 667, pl. xv. figs. 6–8. The last species was suggested by Manzoni, Bry. mioc. Austr. Ungh. iii. (Denk. Akad. Wiss. Wien, vol. xxxviii. pt. ii. (1878), p. 3), to be a synonym of *C. eburnea* (L.).

[4] D'Orbigny. Bry. Crét. p. 600.

[5] A. W. Waters. Foss. Cycl. Austral.: Quart. Journ. Geol. Soc. vol. xl. (1884), p. 683.

The absorption of the genus *Crisidia* in *Crisia* leaves that genus as the only member of its family. The family is usually separated as an independent section of the Cyclostomata, on account of its articulated zoarium; apart from this character the zoœcia are very similar to those of the simplest forms of *Crisina*, such as *Crisina unipora*. That species (see *e.g.* the figures in Vol. I. Pl. VIII. Figs. 5, 6) unquestionably resembles some species of *Crisia*; but the fact that the specimens of *Crisina unipora* are often long and show no signs of articulation, combined with the occasional biserial apertures, precludes their inclusion in *Crisia*. The difference is, however, not very great between *Crisina unipora* and such species as the fossil *Crisia scalaris*, Macgillivray,[2] from Corio Bay, Victoria, in which the internodes are long and may have as many as twenty zoœcia.

UNREPRESENTED SPECIES.

1. **berardi**, Pergens, 1892.

Syn. *Crisia berardi*, Pergens, 1892. Nouv. Cycl. Crét.: Bull. Soc. belge Géol. vol. iv., Mém. p. 278, pl. xi. fig. 5.

Char.—Zoarium articulate; each internode consists of two zoœcia. Each segment is from 1 to 1·2 mm. long; the maximum diameter of the zoœcia is ·3 to ·35 mm., and the diameter of the apertures is ·2 to ·22 mm. in diameter. Walls punctate.

Distrib.—Cenomanian: Plauen, Saxony.

Aff.—M. Pergens has described some smaller fragments of simple tubular zoœcia from the Cenomanian of Plauen in Saxony as members of this genus. The material is scanty, and only small fragments are known, and this fact is regarded by M. Pergens as proof of the articulate structure of the zoarium.

The figures given by M. Pergens are quite consistent with the reference of this species to *Crisia*, though they might be young specimens of *Filisparsa*.

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[1] *Cf. e.g.* the figure by Waters, *op. cit.* pl. xxx. fig. 1, with those in Cat. Cret. Bry. vol. i. pl. viii. figs. 5, 6.

[2] Macgillivray. Mon. Tert. Polyz. Vict.: Trans. Roy. Soc. Vict. vol. iv. (1895), p. 119, pl. xvi. fig. 1.

2. ? **compressa** (d'Orbigny), 1853.

SYN. *Unicrisia compressa*, d'Orbigny, 1853. Bry. Crét. p. 600, pl. 734, figs. 12–14.

CHAR.—Known by three zoœcia which are very compressed. Peristomes highly raised. Surface smooth; sutures between the zoœcia obliterated.

DISTRIB.—Senonian: near La Ferté-Bernard, Sarthe.

AFF.—The generic position of the type fragment is doubtful. There is no trace of the articulation, and the peristomes are unusually highly developed.

3. **plauensis**, Pergens, 1892.

SYN. *Crisia plauensis*, Pergens, 1892. Nouv. Cycl. Crét.: Bull. Soc. belge Géol. vol. iv., Mém. p. 277, pl. xi. fig. 4.

CHAR.—Zoarium articulate; each internode contains from four to six zoœcia. The length of the segments is from 1·5 to 1·75 mm.; the maximum diameter of the zoœcia reaches from ·15 to ·17 mm.; the apertures are ·1 to ·12 mm. in diameter. Walls smooth.

DISTRIB.—Cenomanian: Plauen, Saxony.

4. **schmitzi**, Pergens, 1892.

SYN. *Crisia schmitzi*, Pergens, 1892. Nouv. Cycl. Crét.: Bull. Soc. belge Géol. vol. iv., Mém. p. 277, pl. xi. figs. 1–3.

CHAR.—Zoarium articulate; each internode includes one or two zoœcia, and each segment is from 1·5 to 1·75 mm. long. Zoœcia from ·25 to ·3 mm. diameter, with apertures ·15 to ·2 mm. diameter. Walls smooth.

DISTRIB.—Cenomanian: Plauen, Saxony.

Family THEONOIDÆ, Busk, amended.[1]

DIAGNOSIS.

Cyclostomata Tubulata in which the zoœcia are simple, short, open tubes. They often pass through a *Defrancia*-stage. The zoœcia are monomorphic. The apertures occur in bands either along raised ridges or along the edges of the fronds.

ACTINOPORA, d'Orbigny, 1853.

[Bry. Crét. p. 762.]

SYNONYMS.

Actinopora, d'Orbigny, 1853.
Tubulipora, *pars*, M.-Edwards, 1838; Manzoni, 1877.
Lichenopora, *pars*, Defrance, 1823.
,, (*non* Defrance), Haime, 1854; Ubaghs, 1879; Pergens, 1887.
Ceriopora, *pars*, Goldfuss, 1827; de Verneuil, 1838, etc.

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[1] *Cf.* Cat. Jur. Bry. pp. 172, 173.

Discopora, *pars*, Woodward, 1833.
Defrancia, *pars*, von Hagenow, 1851.
Radiocavea, *pars*, d'Orbigny, 1854.
Pavotubigera, d'Orbigny, 1853.
Unitubigera, d'Orbigny, 1853.
Radiotubigera, d'Orbigny, 1853.
Discotubigera, d'Orbigny, 1853.
Reptopora, de Loriol, 1868.
Liripora, *pars*, Macgillivray, 1887.
Discocavea, *pars*, Marsson, 1888.
Apsendesia, *pars*, Vine, 1893.

DIAGNOSIS.

Theonoidæ in which the zoarium is a flat, simple, adnate disc. The apertures open on a series of ridges, which radiate from a central depression. There may be a flat peripheral selvage.

TYPE SPECIES.

Actinopora stellata (Koch & Dunker), 1837. Neocomian: Germany.

AFFINITIES.

The generic name, as here defined, has the following synonyms:— *Pavotubigera* [1] includes species in which the radial centre is excentric in position; *Radiotubigera*,[2] those in which the apertures are uniserial; *Discotubigera*,[3] a series with biserial or triserial radii and slightly raised edges; *Unitubigera* [4] has very narrow uniserial rows, which are somewhat ill-defined.

Reptopora, de Loriol,[5] was founded on a species from the Swiss Valangian which is allied to *A. brongniarti* (M.-Edw.). *Liripora*, Macgillivray,[6] was founded for two recent species from Port Philip Heads, Victoria: the one species, *L. lineata* (Macg.), is an *Actinopora*; the other, *Diastopora fasciculata* (Macg.), belongs to a distinct genus.

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[1] D'Orbigny. Bry. Crét. p. 766.

[2] *Ibid.* p. 756.

[3] *Ibid.* p. 757.

[4] *Ibid.* p. 759.

[5] De Loriol. Valang. Arzier.: Mat. Pal. Suisse, ser. 4, pt. ii. (1868), p. 63.

[6] Macgillivray. Descr. New Polyz. pt. xii.: Trans. Roy. Soc. Vict. vol. xxiii. (1887), p. 182. Cat. Mar. Polyz. Vict.: *ibid.* p. 218. On *Diastopora lineata*, Macg.: Descr. New Polyz. pt. vii. *ibid.* vol. xxi. (1885), p. 96, pl. iii. fig. 1; on *D. fasciculata*: *ibid.* p. 97, pl. iii. fig. 2.

1. **Actinopora brongniarti** (Milne-Edwards), 1837.

SYNONYMY.

Tubulipora brongniarti, Milne-Edwards, 1837. Mém. Tubul.: Ann. Sci. nat., Zool., ser. 2, vol. viii. p. 334, pl. xiv. fig. 1.
,, ,, Michelin, 1843. Icon. Zooph. p. 122, pl. xxxi. fig. 4.
non ,, ,, Manzoni, 1877. Brioz. Mioc. Austr. Ungh.: Denk. Akad. Wiss. Wien, vol. xxxviii. pt. ii. p. 20, pl. xviii. fig. 73.
Defrancia ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 266.
Actinopora ,, d'Orbigny, 1853. Bry. Crét. p. 762.
,, *cretacea*, d'Orbigny, 1851. *Ibid.* pl. 643, figs. 5–8.
,, ,, d'Orbigny, 1853. *Ibid.* pl. 763.
,, *diademoides*, d'Orbigny, 1851. *Ibid.* pl. 643, figs. 9–11.
,, ,, d'Orbigny, 1853. *Ibid.* p. 764.
,, ,, Gamble, 1896. Cat. Bry. Chatham, p. 5.
Defrancia ,, Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 510.
Apsendesia ,, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 333.

DIAGNOSIS.

Zoarium circular, well raised. There is a well-developed central depression and a rather broad peripheral selvage.

Radii short, triangular, flabellate, and highly raised (less prominent in the typical form, var. *brongniarti*). The rays begin uniserially and rapidly widen until they are multiserial.

DIMENSIONS.

	A typical *brongniarti* (M.-Edw.). B.M., D. 3098. Pl. I. Fig. 1.	Var. *cretacea*. B.M., D. 4477. Pl. I. Fig. 2.
Diameter of zoarium ...	3 mm. ...	3·3 × 3·1 mm.
Thickness of zoarium ...	·5 mm. ...	·6 mm.
Number of rays	14 ...	17
Diameter of apertures ...	·06–·08 mm. ...	·06 mm.

DISTRIBUTION.

ENGLISH:

Upper Chalk—Zone of *Micraster coranguinum*: Dover; Gravesend.

FOREIGN:

Senonian—Maastrichtian: Maastricht; Ste. Colombe, Manche.
Campanian: Meudon; Seine-Inférieure.

FIGURES.

Pl. I. Fig. 1. A zoarium of the typical Meudon form, attached to a fragment of *Echinocorys scutatus*, Leske; × 10 dia. Upper Chalk: Dover. J. S. Gardner Coll. **D. 3098.**

Pl. I. Fig. 2. A zoarium intermediate between the typical *A. brongniarti* and *A. cretacea*, d'Orb.; × 10 dia. Upper Chalk: south-east of England. Purchased from F. H. Butler. **D. 4477.**

AFFINITIES.

This Actinoporan occurs in two forms, which appear to me to be only varieties, due possibly to differences in the depth at which they grew. Milne-Edwards founded the species under the name *Tubulipora brongniarti* on a specimen from Meudon, in which the rays are long and some of them may be uniserial; but some of the rays expand into triserial groups, which are distinctly triangular, passing from a central uniserial to an outer multiserial condition.

Unfortunately most authors have taken a form with long narrow biserial rays as *A. brongniarti*; but Milne-Edwards' figure leaves no doubt as to the characters of his species.

A second variety was described by d'Orbigny as *Actinopora cretacea*; it has a broad peripheral zone of small zoœcia, and the rays are usually biserial. I was at first inclined to regard this as a distinct species, but a specimen (**D. 4477**) shown on Pl. I. Fig. 2 has some short, triangular, multiserial rays between the biserial rays. Such specimens indicate that *A. cretacea* is a variety of *A. brongniarti*. D'Orbigny's *A. diademoides* necessarily follows with *A. cretacea*, as it appears to be only a form in which the margin overhangs.

A. brongniarti is allied to *A. diadema* (Goldf.), as both have sometimes triangular, triserial rows of apertures; but in *A. brongniarti* the rows are long and low, whereas in *A. diadema* they rise in short, tooth-shaped groups, resembling *Discofascigera*.

LIST OF SPECIMENS.

BRITISH.

D. 3098. A zoarium of the typical Meudon form, attached to a fragment of *Echinocorys scutatus*, Leske (on slide). Upper Chalk. Dover. J. S. Gardner Coll. Figd. Pl. I. Fig. 1.

D. 4477. A zoarium of the variety intermediate between the typical *A. brongniarti* and *A. cretacea*, d'Orb., attached to an echinoid plate. Upper Chalk. South-east of England. Purchased from F. H. Butler. Figd. Pl. I. Fig. 2.

D. 4456. Two very young zoaria on an ossicle of *Bourgueticrinus*. Upper Chalk — zone of *Micraster coranguinum*. Gravesend, Kent. Wetherell Coll.

FOREIGN.

D. 3774. A zoarium (on slide). Maastrichter Kalk. Maastricht. Gamble Coll. This specimen was identified by M. Pergens as *Apsendesia disticha*; its rays, however, are short and triangular, and since the apertures are triserial at the end it is an *A. brongniarti.*

2. **Actinopora disticha** (von Hagenow), 1851.

SYNONYMY.

Defrancia disticha, von Hagenow, 1851. Bry. maastr. Kr. p. 42, pl. iv. fig. 1.
,, ,, Schlüter, 1870. Reise südl. Schwed.: N. Jahrb. 1870, p. 940.
,, ,, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv. p. 39.
Actinopora ,, d'Orbigny, 1853. Bry. Crét. p. 763.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 27.
Lichenopora ,, Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 212.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limbourg, p. 225.
Apsendesia disticha, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 32.
Actinopora gaudryna, d'Orbigny, 1851. Bry. Crét. pl. 644, figs. 1–4.
,, ,, d'Orbigny, 1853. *Ibid.* p. 765, pl. 752, figs. 1–3.
Lichenopora gaudryana, Winkler, 1864. *Op. cit.* p. 225.
Defrancia ,, *pars*, Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 509.
Apsendesia ,, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, pp. 322, 323.
Defrancia excavata, d'Orbigny, 1851. Bry. Crét. pl. 644, figs. 5–8.
,, ,, Ubaghs, 1858. Neue Bry. Maestr.: Pal. vol. v. p. 128.
,, *pulchella*, d'Orbigny, 1851. Bry. Crét. pl. 644, figs. 9–12.
,, *brongniarti* (*non* Edw.), d'Orbigny, 1851. *Ibid.* figs. 13–15.
Discotubigera santonensis, d'Orbigny, 1853. *Ibid.* p. 758, pl. 751, figs. 12–16.
Pavotubigera flabellata, d'Orbigny, 1853. *Ibid.* p. 767, pl. 752, figs. 4–8.
,, cf. ,, Peron, 1888. Craie S.E. Bass. Anglo-Par.: Bull. Soc. Sci. nat. Yonne, vol. xli. pp. 225, 343, pl. iii. fig. 24.
,, ,, Canu, 1900. Géol. Romorantin: Bull. Soc. géol. France, ser. 3, vol. xxviii. p. 103.
,, ,, Canu, 1900. Bry. Tours: C.R. Assoc. franç. Av. Sci. 1899, p. 410.
? *Lichenopora cretacea*, Defrance, 1823. Lichenopore: Dict. Sci. nat. vol. xxvi. p. 257.

DIAGNOSIS.

Zoarium circular and flat; the rays radiate from the centre or from a central depression, or in var. *flabellata* the radial point is strongly excentric. The peripheral selvage is usually narrow, but broad in var. *regularis.*

Rays composed of biserial zoœcia. The rays are very numerous, and there may be four or five orders. In young zoaria the rays are proportionately broader than in old zoaria.

Some zoaria are compound, consisting of several sub-colonies growing in the same sheet.

DIMENSIONS.

	Var. *gaudryana.* D. 4582. Pl. I. Fig. 3.	The chief sub-colony in D. 3427, a compound zoarium from Maastricht.
Diameter of disc ...	3·5 × 3·0 mm. ...	9 × 10 mm.
Thickness of disc ...	·4 mm. ...	—
Number of rays ...	18 ...	16
Diameter of apertures	·06–·08 mm. ...	·08 mm.

DISTRIBUTION.

ENGLISH:

Upper Chalk—Zone of *Belemnitella mucronata*: Clarendon, Wilts (*fide* Vine).
Zone of *Micraster coranguinum*: Gravesend; south-east of England; Dover; Bromley, Kent.
Middle Chalk—Zone of *M. cortestudinarium*: Chatham.

FOREIGN:

Danian: Annetorp, Sweden (*fide* Hennig).
Senonian—Maastrichtian: Maastricht; Royan, Charente-Inférieure.
Campanian: Meudon, near Paris; Reims (*fide* Peron). Also Seine-Inférieure (*fide* Bucaille); Ignaberga, Balsberg, Ö. Karup, etc., Sweden (*fide* Hennig).
Santonian: Saintes, Charente-Inférieure; Romorantin, Loir-et-Cher.
Coniacian: Vendôme and Villedieu, Loir-et-Cher; Tours and St. Christophe, Indre-et-Loire.
Senonian general: Veules, Seine-Inférieure; Bougniaux and Pons, Charente-Inférieure; Merpins, Charente.

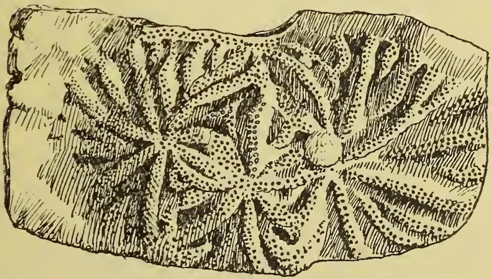

FIG. 11.—*Actinopora disticha*; × 3.

FIGURES.

Pl. I. Fig. 3. A zoarium of var. *gaudryana*, Orb., attached to a plate of *Echinocorys scutatus*, Leske; × 10 dia. Upper Chalk: south-east of England. Morris Coll. **D. 4582.**

Fig. 11, p. 9. Three confluent colonies; × 3 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3427.**

AFFINITIES.

This 'species' is most nearly allied to *A. brongniarti* (Orb.), from which it differs by having long, narrow biserial, instead of short, triangular, triserial to multiserial rays. The species has three main varieties—var. nov. *regularis*, with a broad selvage; var. *flabellata* (d'Orb. as sp.), with an excentric radial centre; var. *gaudryana* (d'Orb. as sp.), with lower and more numerous rays than in the typical form from Maastricht.

The *Lichenopora cretacea* of Defrance is clearly an *Actinopora*, and from its dimensions (4–6 mm.), and from the distribution assigned to it (Meudon, Maastricht, and Nehou), it is more probably *Actinopora disticha* than *A. brongniarti*, which is very rare at Maastricht; but Defrance's description is inadequate, and does not even mention whether the rays are biserial or uniserial. Hence his name cannot be adopted. The remaining species which Defrance included in *Lichenopora* are the Eocene *L. turbinata*, the type of the genus *Lichenopora*, and *L. crispa*, which is referred by d'Orbigny to *Discocavea*.

For possible relations to *Multitubigera gregaria* see p. 23.

LIST OF SPECIMENS.

BRITISH.

D. 4582. A zoarium of var. *gaudryana*, attached to a plate of *Echinocorys scutatus*, Leske (on slide). Upper Chalk. Loc.? Morris Coll. Figd. Pl. I. Fig. 3, as showing especially well the arrangement of the central zoœcia.

D. 4583. A similar zoarium of var. *gaudryana*, attached to an echinid plate (on slide). Upper Chalk. Loc.? Morris Coll.

50,465. Two zoaria of var. *gaudryana*, attached to fragments of *Echinocorys scutatus*, Leske. Upper Chalk. Loc.? Morris Coll.

50,458. Two zoaria of var. *gaudryana*, attached to echinid plates (on slide). Upper Chalk. England. Loc.? Morris Coll.

D. 4266. A zoarium with highly raised radii, intermediate between the typical var. *disticha* and var. *gaudryana*. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

57,527. A zoarium similar to the last, attached to echinid plate (on slide). Upper Chalk. Bromley, Kent. J. Simmons Coll.

D. 4455. A small zoarium approximating to var. *flabellata*, attached to echinid plate (on slide). Upper Chalk—zone of *Micraster coranguinum*. Gravesend. Wetherell Coll.

D. 3119. A zoarium with short radii, attached to echinid plate (on slide). Upper Chalk. England. Old Coll.

D. 11,800. A large zoarium of var. *gaudryi*, attached to plates of *Echinocorys scutatus*, Leske (on slide). Upper Chalk. Dover. J. S. Gardner Coll.

D. 4457. A small zoarium of var. *gaudryi*, attached to echinid plates (on slide). Upper Chalk — zone of *Micraster coranguinum*. South-east England. Wetherell Coll.

D. 467. A zoarium with *Membranipora* sp., on *Micraster cortestudinarium*. Upper Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

D. 3097. A zoarium of var. *gaudryi* on a fragment of *Echinocorys*. Upper Chalk. Loc.? Bowerbank Coll.

FOREIGN.

Var. *disticha*.

D. 5141. A zoarium with ridges of the type of *disticha*, but quadriserial in places. It is attached to an indeterminable Cyclostomatous stem. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 5142. Three zoaria. One has some radii biserial in places; but on these a third aperture occurs at intervals, and in the same specimen there are quadriserial to wedge-shaped groups of multiserial apertures. The other specimens have the long rays multiserial with apertures of the same size as those of *A. stellata* and *diadema*; the specimens suggest that the *disticha* of Hagenow may be only a variety of *diadema* with narrow carinate radii. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3427. Four specimens of confluent forms; one is 20 mm. long by 10 mm. across, and has three centres of growth. Maastrichter Kalk. Maastricht. Van Breda Coll. One specimen is illustrated by Fig. 11, p. 9.

D. 3455. Two zoaria growing along cylindrical stems; ridges rather long and reaching nearly to the centre (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3456. A zoarium and a fragment with rather long ridges (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3473. A worn zoarium of a long variety, 9 mm. dia. by 4 mm. wide (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

3. **Actinopora complanata** (Römer), 1840.

SYNONYMY.

Discopora radiata, Woodward, 1833. Geol. Norfolk, p. 46, pl. iv. fig. 3.
Defrancia complanata, Römer, 1840. Verst. nordd. Kr. p. 19, pl. v. fig. 19.
,, ,, d'Archiac, 1846. Crét. vers. Plat. Centr.: Mém. Soc. géol. France, ser. 2, vol. ii. p. 58.

Defrancia complanata, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 266.
Radiotubigera ,, d'Orbigny, 1853. Bry. Crét. p. 756.
Discocavea ,, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv. p. 41.
Unitubigera laxata, d'Orbigny, 1853. Bry. Crét. p. 759.
Actinopora papyracea, d'Orbigny, 1851. Bry. Crét. pl. 643, figs. 12–14.
Lichenopora ,, Pergens, 1888. Tuf. Ciply: Bull. Soc. belge Géol. vol. i. p. 205.
,, ,, Canu, 1900. Bry. Tours: C.R. Assoc. franç. Av. Sci. 1899, p. 410.
Unitubigera ,, d'Orbigny, 1853. Bry. Crét. p. 761.
,, ,, Vine, 1891. Rep. Crét. Polyz.: Rep. Brit. Assoc. 1890, p. 396.
Apsendesia ,, Vine, 1891. *Ibid.* p. 386.
,, ,, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, pp. 313, 333.
,, ,, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx. Acta Physiogr. No. viii. p. 32.
Lichenopora organisans, d'Orbigny, 1851. *Ibid.* pl. 646, figs. 9–13.
,, ,, Pergens & Meunier, 1887. Bry. gar. Faxe: Ann. Soc. malac. Belg. vol. xxi., Mém. p. 230.
,, ,, Canu, 1900. Géol. Romorantin: Bull. Soc. géol. France, ser. 3, vol. xxviii. p. 103.
Radiotubigera ,, d'Orbigny, 1853. Bry. Crét. p. 757.
Defrancia ,, Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 509.
Apsendesia ,, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 313.
Lichenopora ,, Vine, 1893. *Ibid.* p. 333.
Defrancia disciformis (*non* Münst.), von Reuss, 1846. Verst. böhm. Kr. p. 64, pl. xiv. fig. 34.
non Cellepora ,, von Münster, 1829. In Goldfuss, Petref. Germ. vol. i. p. 105, pl. xxxvii. fig. 4.
Defrancia subdisciformis, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 266.
Unitubigera ,, d'Orbigny, 1853. Bry. Crét. p. 760.
Defrancia ,, von Reuss, 1874. Bry. ob. Plän.: Palæontogr. vol. xx. pt. ii., p. 132, pl. xxv. fig. 7.

DIAGNOSIS.

Zoarium circular or subcircular; very depressed; with the peripheral selvage either broad, or narrow in var. *laxata* (d'Orb.).

Rays of uniserial zoœcia; narrow, crowded, and often curved; they may, however, be straight and regular, or slightly irregular. The rays are long, with a narrow selvage in the typical long-spoked variety, but they are short with a broad selvage in var. *papyracea.* There may be a central area of crowded, irregular apertures.

DIMENSIONS.

	Short-spoked variety. D. 2695. Pl. I. Fig. 5.	Long-spoked variety. D. 3109. Pl. I. Fig. 4.	Var. *subdisciformis*. D. 4245. Pl. I. Fig. 6.
	mm.	mm.	mm.
Diameter of zoarium ...	2·7 × 2·3	3·3 × 4·1	5
Thickness of zoarium ...	about ·4	·5 (of each colony).	·7
Number of rays	about 20	about 36	about 50
Length of rays	up to 1·3	up to 1·8	up to 3
Breadth of selvage	—	·2	—

DISTRIBUTION.

ENGLISH:

Upper Chalk: Bromley, Kent; Norwich.
Middle Chalk—Zone of *Micraster cortestudinarium*: Chatham.

FOREIGN:

Danian: Faxoe; ? Ciply.[1]
Senonian—Campanian: Meudon, near Paris; Karlshamn, Sweden.
Santonian: Saintes, Charente-Inférieure; Romorantin, Loir-et-Cher.
Coniacian: Les Roches, Loir-et-Cher; Tours; Fécamp, Seine-Inférieure.
Senonian general: Pons, Charente-Inférieure; Sarstedt, Germany.
Cenomanian—Lower Pläner (var. *subdisciformis*): Schillinge, near Bilin, Bohemia; Strehlen, Saxony.

FIGURES.

Pl. I. Fig. 4. A zoarium of the long-spoked variety, attached to a fragment of *Echinocorys scutatus*; × 10 dia. Upper Chalk: Bromley, Kent. Bowerbank Coll. **D. 3109.**

Pl. I. Fig. 5. A zoarium of a young, short-spoked variety; × 10 dia. Middle Chalk—zone of *Micraster cortestudinarium*: Chatham. Vine Coll. **D. 2695.**

Pl. I. Fig. 6. A heaped zoarium of the var. *subdisciformis* (d'Orb.); × 7 dia. Middle Chalk—zone of *Micraster cortestudinarium*: Chatham. Gamble Coll. **D. 4245.**

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[1] The Ciply specimens may come from the lower horizon at Ciply, which is Campanian.

AFFINITIES.

The essential feature which distinguishes this 'species' from the previously described members of the genus is its uniserial rays. D'Orbigny regarded this character as of generic importance and founded the genus *Unitubigera*.

Woodward's name *D. radiata* can hardly be accepted, as it was explained only by a practically indeterminable figure.

The Cenomanian form, the *A. subdisciformis* (d'Orbigny), has sinuous, long, crowded rows, which at first sight appear to distinguish it from the Senonian form; but some of the specimens from Chatham agree so well with the specimen figured by von Reuss as *subdisciformis* that, in spite of the difference in age, I feel constrained to unite them, leaving the Cenomanian form as only a variety.

LIST OF SPECIMENS.

BRITISH.

D. 3109. A group of zoaria of the typical, long-spoked variety attached to *Echinocorys scutatus*, Leske. Upper Chalk. Bromley, Kent. Bowerbank Coll. Figd. Pl. I. Fig. 4.

D. 2695. A young zoarium with the spokes further apart than in full-grown zoaria. Middle Chalk. Chatham. Vine Coll. Figd. Pl. I. Fig. 5.

D. 4245. A zoarium of the heaped up var. *subdisciformis*. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll. Figd. Pl. I. Fig. 6.

D. 386. Two young thick zoaria (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll. (identified by Gamble as *Apsendesia organisans*).

D. 4265. A large zoarium growing on *Inoceramus*. Upper Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

D. 4259. A zoarium growing in echinid plate (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

D. 4075. A group of zoaria on fragment of *Echinocorys scutatus*, Leske (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Gamble Coll.

D. 2754. A zoarium on an echinid fragment (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. G. R. Vine Coll.

D. 2753. A large zoarium on echinid plate (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. G. R. Vine Coll.

D. 687. A young zoarium of form *organisans*, Orb. (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. G. R. Vine Coll., Nos. 88*a*, 19*g*; recorded as *Apsendesia papyracea, forma organisans*.

D. 684. A zoarium attached to echinid plate (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll., Nos. 88, 19*g*; recorded as *Unitubigera papyracea*.

D. 4199. Three zoaria on a test of *Echinocorys scutatus*, Leske, with eleven other Bryozoa. Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

4. **Actinopora convexa** (Römer), 1840.

SYNONYMY.

Defrancia convexa, Römer, 1840. Verst. nordd. Kr. p. 20, pl. v. fig. 18.
,, ,, von Reuss, 1846. Verst. böhm. Kr. p. 65, pl. xiv. figs. 32*a*, *b*.
Unitubigera ,, d'Orbigny, 1853. Bry. Crét. p. 759.
? *Discopora mamillata*, Woodward, 1833. Geol. Norfolk, p. 46, pl. iv. fig. 2.

DIAGNOSIS.

Zoarium thick and conical, with convex, upper surface, and depressed centre. Apertures in uniserial ridges, which are very close to one another. Selvage wide.

DIMENSIONS.

	50,460. Pl. I. Fig. 7.
Diameter of zoarium	3·5 mm.
Thickness of zoarium	·8 ,,
Number of rays	about 17

DISTRIBUTION.

ENGLISH :

Upper Chalk : Norwich.
Middle Chalk—Zone of *Micraster cortestudinarium* : Chatham.

FOREIGN :

Senonian : Gehrden, Germany.
Cenomanian—Lower Pläner : Schillinge, near Bilin, Bohemia (*fide* von Reuss).

FIGURES.

Pl. I. Fig. 7. A zoarium; × 10 dia. Upper Chalk (attached to an *Echinocorys scutatus*). Loc. ? (probably south-east of England). Morris Coll. **50,460.**

AFFINITIES.

This species is allied to *A. complanata*, from which it differs by its conical thick zoarium. Both the first two figures given of this species are poor.

LIST OF SPECIMENS.

50,460. A zoarium attached to plate of *Echinocorys scutatus*, Leske. Upper Chalk. Loc. ? Morris Coll. Figd. Pl. I. Fig. 7.

D. 4261. A zoarium on echinid fragment (on slide). Middle Chalk—Zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

5. **Actinopora diadema** (Goldfuss), 1827.

SYNONYMY.

Ceriopora diadema, *pars*, Goldfuss, 1827. Petref. Germ. vol. i. p. 39, pl. xi. figs. 12*d*, *e* ; ?*f*; *non* p. 104, pl. xxxvii. fig. 3.
,, ,, *pars*, Morren, 1829. Corall. foss. Belg.: Ann. Acc. Groning. 1828, p. 43.
,, ,, Römer, 1840. Verst. nordd. Kr. p. 20, pl. ii. fig. 12.
,, ,, *pars*, Giebel, 1848. Plänerm. Quedlinb.: Zeit. Zool. Zoot. & Paläoz. vol. i. p. 17.
? ,, ,, Dubois de Montpéreux, 1836. Géol. Cauc. et Crimée: Bull. Soc. géol. France, vol. viii. p. 385.
? ,, ,, de Verneuil, 1838. Géol. Crimée: Mém. Soc. géol. France, vol. iii. p. 21.
? ,, ,, Baily, 1858. Invert. Crimea: Quart. Journ. Geol. Soc. vol. xiv. p. 156.
Domopora ,, *pars*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 267.
,, (*Defrancia*) *diadema*, Vine, 1885. Fifth Report: Rep. Brit. Assoc. 1884, p. 150.
Defrancia ,, *pars*, von Hagenow, 1851. Bry. maastr. Kr. p. 43, pl. iv. fig. 2 (*non* 3).
,, ,, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv. p. 39.
Radiocavea ,, d'Orbigny, 1857. Bry. Crét. p. 966, pl. 776, figs. 9–11.
,, ,, Ubaghs, 1888. C.R. Excursion: Bull. Soc. belge Géol. vol. i., Mém. p. 233.
Lichenopora ,, Pergens & Meunier, 1887. Bry. gar. Faxe: Ann. Soc. malac. Belg. vol. xxi. p. 227.
,, ,, Pergens, 1888. Tuf. Ciply: Bull. Soc. belge Géol. vol. i. p. 205.
,, ,, Pergens, 1893. Nouv. Bry. Crét. Limb.: *ibid.* vol. vii., Mém. p. 176, pl. x. fig. 2 (*non* 3 as misprinted in text).
Apsendesia ,, Ulrich, 1900. In Zittel—Eastman, Textbook Palæont. vol. i. p. 265, fig. 427.
Defrancia michelini, von Hagenow, 1851. Bry. maastr. Kr. p. 42, pl. iv. fig. 5.
,, ,, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv. p. 39.
,, ,, Vogel, 1892. Ob. Sen. Irnich: Verh. nat. Ver. preuss. Rheinl. vol. xlix. p. 91.
Discotubigera ,, d'Orbigny, 1853. Bry. Crét. p. 758.
,, ,, Ubaghs, 1890. Descr. Géol. Pal. Limb. p. 222.
Lichenopora ,, Pergens & Meunier, 1887. Bry. gar. Faxe: Ann. Soc. malac. Belg. vol. xxi. p. 229.
Actinopora ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 27.
Apsendesia ,, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 32.

DIAGNOSIS.

Zoarium small, discoid, with a flat, concave, or pointed base. The upper surface bears 8–10 highly raised, tooth-like ridges, which are triangular in shape and consist of multiserial zoœcia at the outer end. Zoaria occasionally confluent.

DISTRIBUTION.

FOREIGN:

Danian: Faxoe; Ciply; Annetorp.
Senonian—Maastrichtian: Maastricht, St. Pierre, and Bemelen; Irnich, Eifel; Sainte-Colombe, Manche.
Lower Maastrichtian: Calcaire de Kunraed (*fide* Ubaghs).
Campanian: Rügen; Ignaberga, Balsberg, etc., Sweden.
Santonian—Plänermergel: Quedlinburg.
? Cenomanian: Baktschserai, Crimea (*fide* de Montpéroux, de Verneuil, and Baily).

DIMENSIONS.

	D. 3462.	D. 3451.	D. 3451.
	mm.	mm.	mm.
Diameter of zoarium	4·6 × 5·5	2	2·5 × 3·5
Internal diameter of zoœcia ...	·05 – ·08	—	—
Diameter of apertures	—	·08–·1	·08 – ·12

FIGURES.

Fig. 12. A thin horizontal section, across a thick zoarium; × 10 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3462.**

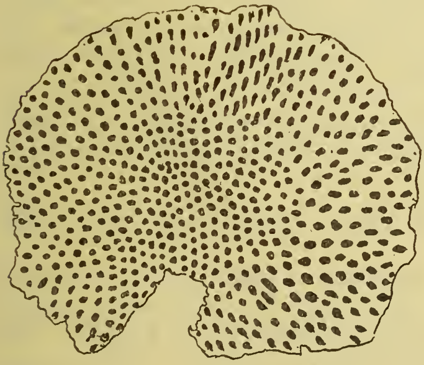

FIG. 12.—*Actinopora diadema*; × 10. **D. 3462.**

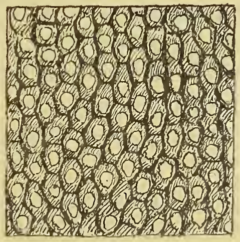

FIG. 13.—*Actinopora diadema.* Part of horizontal section; × 20. **D. 3512.**

Fig. 13, p. 17. Part of a horizontal section across another specimen; × 20 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3512.**

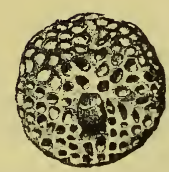

FIG. 14.—*Actinopora diadema*; × 10. **D. 3451.**

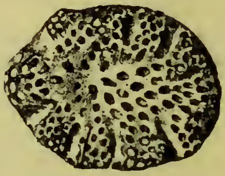

FIG. 15.—*Actinopora diadema*; × 8. **D. 3451.**

Fig. 14. The upper surface of a young zoarium, 2 mm. in dia., attached to a compound specimen formed of two fused zoaria; × 10 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3451.**

Fig. 15. The upper surface of a more advanced but still young colony; × 8 dia. The colony is 2·5 by 3·5 mm. in dia. It is attached to the same zoarium as specimen shown in Fig. 14. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3451.**

AFFINITIES.

This species is common at Maastricht, and is characterized by its triangular teeth. Von Hagenow appears to have included under this name two forms, of which one belongs to this species, and the other (von Hagenow, pl. iv. fig. 4, not fig. 3 as stated, owing to a misprint) is a *Lichenopora costata.* The openings on the floors of the interradii of the former specimen (*ibid.* pl. iv. fig. 2) are due to the breaking away of the epizoarial layer present in perfect specimens.

Hamm's genus *Patenaria* may be based on this species (*vide* p. 25).

The development of this species is illustrated by two figures of young zoaria, both of which are attached to a full-grown compound specimen consisting of a disc, composed of two colonies. The smaller of the young colonies is 2 mm. in diameter. The apertures at this stage are uniformly distributed over the surface, and there is no indication of any fasciculi. The larger of the younger zoaria is shown in Fig. 15. The specimen is in a more advanced stage; it is elliptical in shape and measures 2·5 by 3·5 mm. in diameter; the fasciculi are beginning to develop, being separated by radial grooves covered by an epizoarial layer.

LIST OF SPECIMENS.

D. 3462. Twenty-one simple zoaria, some with a small peduncle overgrown by the lateral outgrowth of the disc; also two slides with thin horizontal and vertical sections. Maastrichter Kalk. Maastricht. Van Breda Coll. Fig. 12, p. 17.

D. 3512. A tube with thirty zoaria, and a slide with a thin horizontal section. Maastrichter Kalk. Maastricht. Van Breda Coll. The horizontal section is figured as Fig. 13, p. 17.

D. 3451. A compound zoarium, with two young colonies attached to the basal colony. Maastrichter Kalk. Maastricht. Van Breda Coll. The two young colonies are shown in Figs. 14 and 15, p. 18.

60,155. A box with about thirty-five compound zoaria, with the bases often concave. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3039. Four zoaria of the variety with flat base and high radial ridges, and therefore the typical shape of *Actinopora diadema*. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3339. Twelve simple zoaria, 6 mm. dia. by 2 mm. thick. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3428. Two attached zoaria, of which one is the var. *michelini*. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3429. One zoarium with well-raised unworn ridges which expand towards the centre, so that they are fusiform or somewhat clavate in shape. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3452. A group of three confluent zoaria of var. *michelini* (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3453. A zoarium (on slide) of a variety with long ridges which reach to the centre; ridges multiserial. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3461. Three simple zoaria. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3463. Four simple zoaria. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3464. Three compound zoaria. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3465. Ten compound zoaria. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3466. Twenty zoaria, including some compound forms (in tube). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3500. A very worn zoarium (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3505. A young zoarium with the bundles rising into spikes (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3511. A tube with twenty zoaria, bases often concave; wide central areas within the ridges. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3515. A compound zoarium of about five sub-colonies, composed of a group of typical *A. diadema*, each 5 mm. in dia., with a young attached zoarium, 1·5 mm. dia. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3572. A thin adnate zoarium (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3719. Two zoaria (in tube), labelled by M. Pergens as *Lichenopora diadema*. Maastrichter Kalk. Maastricht. Gamble Coll. Purchased.

D. 5143. Two young zoaria with fusiform bundles of zoœcia. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 5146. A zoarium of var. *michelini*, Hag., 4·5 by 4 mm. in dia. and 1·5 mm. thick; it has a faint peduncle which has doubtless been retained, as the zoarium appears to have grown on some soft body; many of the zoaria in the species show a rudiment of the peduncle, but it has been buried in the thickness of the zoarium. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 6344. Three zoaria (on slide), labelled by Busk *Lopholepis irregularis*, Hag. Two are compound varieties of *A. diadema*, one of these two being a very good specimen. The third specimen on the slide is a broken tuft probably of this species, but its affinities are more doubtful. Maastrichter Kreide. St. Pierre, Maastricht. Busk Coll. Presented by Miss Busk, 1899.

D. 6346. A compound variety with a fragment of *Lopholepis alternans*, Hag. (on slide), labelled by Busk *Lopholepis radians*, Hag. Maastrichter Kreide. Bemelen. Busk Coll. Presented by Miss Busk.

D. 3321. Twelve sub-colonies in a continuous sheet; one of the colonies has the ridges rather long. Maastrichter Kalk. Maastricht. Old Coll.

UNREPRESENTED SPECIES.

1. **discus** (d'Orbigny), 1853.

Syn. *Unitubigera discus*, d'Orbigny, 1853. Bry. Crét. p. 760, pl. 763, figs. 4–6.

Char.—Thin circular zoarium, with thin selvage, and numerous crowded, uniserial radii.

Distrib.—Neocomian: Sainte-Croix, Vaud.

2. **moneta** (d'Orbigny), 1853.

Syn. *Discotubigera moneta*, d'Orbigny, 1853. Bry. Crét. p. 758, pl. 751, figs. 8–11.

Char.—A near ally of *A. brongniarti*, but the radii extend to the centre of the disc.

Distrib.—Senonian—Coniacian: Vendôme, Loir-et-Cher.

3. **stellata** (Koch & Dunker), 1837.

Syn. *Ceriopora stellata*, Koch & Dunker, 1837. Beitr. nordd. Ool. p. 55, pl. vi. fig. 12.
,, ,, von Hagenow, 1846. In Geinitz, Grundr. Verst. vol. ii. p. 594.
Defrancia (*Ceriopora*) *stellata*, Römer, 1840. Verst. nordd. Kr. p. 20.
,, ,, ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 86.
Actinopora stellata, d'Orbigny, 1853. Bry. Crét. p. 762.
,, *regularis*, d'Orbigny, 1853. *Ibid.* p. 763, pl. 763, figs. 7–9.

Char.—Allied to *A. brongniarti*, but with more regular crowded radial series. Apertures triserial at the ends of the larger radii. Large peripheral zone.

Distrib.—Neocomian—Hilsthon: Elligser Brinke, near Alfeld, Germany; Sainte-Croix, Vaud.

Aff.—This species is well figured by Koch & Dunker, and is the type of the genus.

4. **valangiensis** (de Loriol), 1868.

Syn. *Reptopora valangiensis*, de Loriol, 1868. Valang. Arzier: Mat. Pal. Suisse, ser. 4, pt. ii. p. 63, pl. vi. fig. 4.

Distrib.—Valangian: Arzier in Vaud, Switzerland.

Char.—Thick zoarium with high, short ridges, mostly biserial, but multiserial at the ends of the ridges.

Aff.—Possibly a Valangian ancestor of *A. brongniarti*.

CONOTUBIGERA, d'Orbigny, 1853.

[Bry. Crét. p. 769.]

Synonyms.

Conotubigera, Pergens, 1894; Ulrich, 1900.
Serietubigera, d'Orbigny, 1853; Ulrich, 1900.

Diagnosis.

Theonoidæ in which the zoarium is cylindrical and obconical or clavate, marked externally by vertical ridges, on which open the apertures. The apertures are uniserial or biserial.

Type Species.

C. irregularis, d'Orbigny, 1853. Senonian—Campanian: Meudon.

UNREPRESENTED SPECIES.

1. **dilatata** (d'Orbigny), 1853.

Syn. *Serietubigera dilatata*, d'Orbigny, 1853. Bry. Crét. p. 771, pl. 753, figs. 8–10.

Char.—Zoarium irregular in shape; rising from a pointed base; expanding above with three rays, from which the vertical ridges project widely. Apertures biserial.

Distrib.—Senonian—Campanian: Meudon.

2. **francqana** (d'Orbigny), 1853.

Syn. *Serietubigera francqana*, d'Orbigny, 1853. Bry. Crét. p. 771, pl. 753, figs. 3–7.

Char.—Zoarium regular, clavate; ridges project widely. Apertures biserial.

Distrib.—Senonian—Campanian: Meudon.

3. **hennigi,** Pergens, 1894.

Syn. *Conotubigera hennigi*, Pergens, 1894. Nouv. Bry. Crét. Limb.: Bull. Soc. belge Géol. vol. vii., Mém. p. 175, pl. ix. fig. 2.

Char.—Zoarium funnel-shaped; a conical hollow in the upper surface; a series of about twenty vertical radial plates projects from the upper part of the outer surface of the zoarium. The apertures open on the upper edge of these projections; the apertures are usually in uniserial rows, but sometimes biserial, and on some projections apparently multiserial. Peduncle marked by radial oblique ridges, and all covered by an imperforate lamina.

Distrib.—Senonian—Maastrichtian: Petit-Lanaye, near Maastricht.

Aff.—M. Pergens remarks its resemblance to an irregular *Apsendesia*, but separates it from that genus by its "considerable number" of radial plates, the uniserial or biserial arrangement of the apertures, and especially owing to the occurrence of an "oœcium" in the hollow cone of one specimen.

The species seems to differ markedly from the type species of *Conotubigera*, which consists of a solid obconic zoarium, with the apertures arranged over the sides of the zoarium instead of on projecting Theonoid ridges. It is a very close ally of *Serietubigera francqana*, d'Orb.,[1] also from the Campanian zone of the French Chalk at Meudon. The two species agree in their obconic form, the presence of a conical depression on the upper surface, and the apertures opening along the edges of often biserial ridges; but they differ by the fact that in *S. francqana* the apertures open on the sides as well as on the upper edge of the ridges.

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[1] D'Orbigny. Bry. Crét. p. 771, pl. 753, figs. 3–7.

4. **irregularis**, d'Orbigny, 1853.

SYN. *Conotubigera irregularis*, d'Orbigny, 1853. Bry. Crét. p. 770, pl. 752, figs. 11, 12; pl. 753, figs. 1, 2.

CHAR.—Zoarium simple, clavate, flat-topped. Ridges project but slightly, and the apertures are uniserial.

DISTRIB.—Senonian—Campanian: Meudon.

MULTITUBIGERA, d'Orbigny, 1853.

[Bry. Crét. p. 767.]

SYNONYM.

? *Radiofascigera*, d'Orbigny, 1853.

DIAGNOSIS.

Theonoidæ in which the zoarium is compound, and composed of many confluent *Actinoporæ*.

TYPE SPECIES.

Multitubigera gregaria (d'Orbigny), 1850. Senonian: Royan.

AFFINITIES.

The generic separation of these compound Theonoids appears to have as much justification as, for example, the separation of compound corals from allied simple corals, although the corallites of both have the same combination of characters. Occasional specimens of *Actinopora* are composed of two or three colonies that happen to have grown together, but they do not resemble the massive forms of *Multitubigera*, and are not sufficient to connect the two genera.

For possible affinities with *Radiofascigera* see p. 52.

Multitubigera sulcata,[1] Gregory, 1909.

SYNONYMY.

Multitubigera sulcata, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. 5, vol. vi. p. 61.

DIAGNOSIS.

Zoarium massive and thick. Radial ridges of each zoœcial sub-colony short, thick, and wedge-shaped. Apertures triserial to multiserial at the ends of the radii.

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[1] So named on account of its furrows between the sub-colonies.

The zoœcial colonies are elliptical, and usually separated by valleys or depressed porous areas and not by definite regular laminæ.

DIMENSIONS.

Diameter of zoarium	16 mm.
Diameter of zoœcial sub-colonies ...	4 × 5 ,,
Width of radial ridge at outer end ...	1 ,,
Length of the same	2 ,,
Diameter of apertures	about ·08 ,,

DISTRIBUTION.

Senonian—Maastrichtian: Maastricht.

FIGURES.

Fig. 16. Upper surface of the type-specimen; × 3 dia. Maastrichtian: Maastricht. **D. 11,798.**

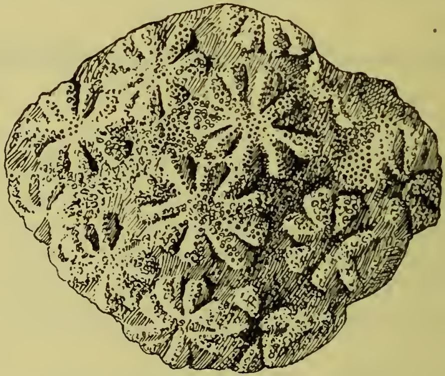

FIG. 16.—*Multitubigera sulcata*; × 3.

AFFINITIES.

The sub-colonies of *M. sulcata* most resemble among *Actinoporæ* those of *A. disticha* (Hag.), owing to their wedge-shaped form; but the sub-colonies are not by any means identical in the two species; the zoarium of *M. sulcata* is quite unlike that of any *Actinopora*. The new species differs from *M. gregaria* by having short, wedge-shaped and not biserial ridges; moreover, the sub-colonies are separated by pore-filled valleys, and are elliptical in shape.

D. 11,798. The type-specimen. Maastrichter Kalk. Maastricht. Fig. 16. Old Coll.

UNREPRESENTED SPECIES.

1. **campicheana,** d'Orbigny, 1853.

Syn. *Multitubigera campicheana*, d'Orbigny, 1853. Bry. Crét. p. 768, pl. 763, figs. 10–13.
,, ,, Canu, 1902. Bry. foss. i., Coll. Camp.: Bull. Soc. géol. France, ser. 4, vol. ii. p. 12.

Char.—The zoarium is irregular, being composed of unequal colonies. Each colony has a broad selvage; the radii are straight, narrow, and biserial.

Distrib.—Neocomian: Sainte-Croix, Vaud.

2. **gregaria** (d'Orbigny), 1850.

Syn. *Radiopora gregaria*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 267.
Multitubigera gregaria, d'Orbigny, 1853. Bry. Crét. p. 769, pl. 752, figs. 9, 10.

Char.—Zoarium massive, irregular; radii well defined, narrow, straight, and biserial.

Distrib.—Senonian—Maastrichtian: Royan, Charente-Inférieure.

PATENARIA, Hamm, 1881.

[Bry. mastr. Ob.-Sen. i., Cycl. p. 33.]

Diagnosis.

Theonoidæ with a simple discoid zoarium, adnate by its whole lower surface; the zoœcia are collected into radial bundles, which form low radial ridges; the apertures are all on the outer edge of the zoarium. The upper surface of the zoarium is covered by a smooth epizoarium.

Type Species.

Patenaria depressa, Hamm. Senonian—Maastrichtian: Maastricht.

Affinities.

This bryozoan, from its description, appears to resemble those species of *Actinopora diadema* (Goldf.) in which the ridges extend almost to the margin of the zoarium and there end in a steep face, and the middle of the zoarium has no apertures. Hamm, however, places the genus in the Osculiporidæ, so that this resemblance may be misleading.

UNREPRESENTED SPECIES.

depressa, Hamm, 1881.

Syn. *Patenaria depressa*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 33.

Char.—Zoarium round, very thin, flat or concave. The zoœcial bundles are low and their upper edge is well rounded; they branch once or repeatedly; their arrangement may be fan-shaped or regularly radial. The edges of the bundles on the edge of the colony have about three series of small cells.

Distrib.—Senonian—Maastrichtian: Maastricht.

Aff.—Possibly a near ally of *Actinopora diadema* (Goldf.).

THEONOA, Lamouroux, 1821.

[Expos. Méth. p. 82.]

Synonyms.

Tilesia, *pars*, Lamouroux, 1821.
Phyllofrancia, Marsson, 1887.
Theonoa, *pars*, Ulrich, 1900.

Diagnosis.

Theonoidæ with a massive or frondose zoarium, attached at the base; apertures in multiserial, raised, branching bands, which radiate from the base to the top edges of the fronds; apertures crowded on the margin.

Type Species.

Theonoa clathrata, Lamouroux, 1821. Bathonian: France.

Affinities.

A Theonoid with erect fronds. The genus began in the Jurassic.

UNREPRESENTED SPECIES.

grandis (Marsson), 1887.

Syn. *Phyllofrancia grandis*, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv. pt. i. p. 43, pl. iv. fig. 2.

Char.—The frond is 10 mm. wide and long; the bands of apertures are triserial or quinquiserial. Interspaces smooth.

Distrib.—Senonian—Campanian: Rügen.

LOCULARIA, Hamm, 1881.

[Bry. mastr. Ob.-Sen. i., Cycl. p. 44.]

DIAGNOSIS.

Theonoidæ with a simple zoarium attached by the whole of the lower side; the outline is sickle-shaped or semicircular; the posterior margin is low, while the anterior margin is well raised. Upper surface covered by a smooth epizoarial layer. The zoarium is divided into compartments by divergent, vertical partition walls.

Zoœcia with thin apertures, which open only on the anterior margin of the zoarium. The apertures are more or less equal; those on the sides of the partition walls project above those in the middle.

TYPE SPECIES.

Locularia semipatina, Hamm. Maastrichtian: Maastricht.

AFFINITIES.

This genus, with its simple subequal zoœcia, appears to be a member of the Tubulata, with the apertures occurring in a band along the anterior margin of the adnate zoarium. It may be regarded as a Theonoid, in which the zoarium is divided into compartments by laminæ like those of *Stellocavea*; but its resemblance to *Stellocavea*, due to the laminæ, is less important than the marginal position of the apertures and the monomorphic nature of the zoœcia, whereby it is allied to the Theonids.

UNREPRESENTED SPECIES.

1. damesii, Hamm, 1881.

SYN. *Locularia damesii*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 45.

CHAR.—Zoarium transversely elongate, slightly sickle-shaped. It becomes rapidly thicker to the front, with a steep slope and vertical anterior margin. Compartments always completely open, short, and wide. Zoœcia raised high laterally on the partition wall; lying in about six horizontal rows, of three to six zoœcia in each. A small pore under each aperture.

DISTRIB.—Senonian—Maastrichtian: Maastricht.

2. semipatina, Hamm, 1881.

SYN. *Locularia semipatina*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 44.

CHAR.—Zoarium approximately semicircular. It gradually becomes thicker towards the front. Compartments comparatively long and narrow; usually contracted by widening of the front border of the partition walls.

DISTRIB.—Senonian—Maastrichtian: Maastricht.

RETENOA,[1] Gregory, 1909.

[New Cret. Bry.: Geol. Mag. dec. 5, vol. vi. p. 62.]

SYNONYM.

Frondipora, pars, d'Orbigny, 1853.

DIAGNOSIS.

Theonoidæ with an erect frondose zoarium, composed of a network of dichotomous, anastomosing branches. The apertures all open on one face of the zoarium.

TYPE SPECIES.

Retenoa campicheana (d'Orb.), 1853. Neocomian: Sainte-Croix, Switzerland.

AFFINITIES.

This genus is a Theonoid with an erect reticular zoarium. The type species was placed by d'Orbigny in the *Frondipora* of de Blainville. *Frondipora*, however, is an Osculiporid nearly allied to *Homœosolen*. Its type species is the common Mediterranean *F. reticulata* (L.), which has been well figured, as for example by Lamouroux and Busk;[2] it has a frondose zoarium, with the apertures opening in tufts or on an irregular ridge along the obverse face of the zoarium. *Frondipora* may be regarded as an *Homœosolen* in which the apertures are confined to a sinuous broken ridge, instead of opening on the whole obverse surface and on lateral processes.

D'Orbigny[3] founded the genus *Rhyzopora* on the type species of *Frondipora*, so the two names are necessarily synonyms, as he recognized in 1853.[4]

Retenoa campicheana (d'Orbigny), 1853.

SYNONYMY.

Frondipora campicheana, d'Orbigny, 1853. Bry. Crét. p. 678, pl. 783, figs. 12–16.
,, ,, Canu, 1902. Bry. foss. i., Coll. Camp.: Bull. Soc. géol. France, ser. 4, vol. ii. p. 11.

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[1] The name is given as an abridgment of *Rete-theonoa*, the theonid with a net-shaped zoarium.

[2] Lamouroux: Exposition Méth. Polyp. p. 41, pl. lxxiv. figs. 10–13. G. Busk: Cat. Mar. Polyz. B.M. pt. iii., Cycl. 1875, p. 38, pl. xxi.

[3] D'Orbigny. Descrip. Genres nouv. Bryoz.: Rev. Mag. Zool. ser. 2, vol. i. (1849), p. 504.

[4] D'Orbigny. Bry. Crét. p. 677.

DIAGNOSIS.

Zoarium a flat frond, all in one plane. Long oval interspaces between the anastomosing branches. Branches laterally compressed, with long grooves along the sides. Obverse surface sharply ridged.

Apertures all on the narrow obverse edges of the branches; they are crowded and irregular in arrangement. The apertures are slightly raised; there are from two to four series of apertures on the front of each stem.

DIMENSIONS.

Width of the obverse edge of the branches	...	1·5 mm.
Thickness of the branches (obverse to reverse)	...	2 ,,

DISTRIBUTION.

Hauterivian—Calcaire jaune: Meil, near Neufchatel.
Neocomian: Sainte-Croix, Vaud, Switzerland.

AFFINITIES.

The Museum specimens of this species agree in all essentials with the characters shown in d'Orbigny's figures. But one specimen (**D. 3666**) has part of the obverse surface exceptionally well preserved, and there the peristomes project with slightly raised rims, as in ordinary Tubulate Cyclostomata. The number of apertures in the width of the stem in this specimen is three or four.

LIST OF SPECIMENS.

D. 3665. Three fragments of a zoarium and two others (on slide). Hauterivian—Calcaire jaune. Meil, near Neufchatel. Bruckmann Coll.

D. 3666. A broken zoarium and fragment of the same mounted on a slide. Part of the front edge of the zoarium is well preserved. Hauterivian—Calcaire jaune. Meil, near Neufchatel. Bruckmann Coll.

D. 3667. A zoarium showing reverse surface. Hauterivian—Calcaire jaune. Meil, near Neufchatel. Bruckmann Coll.

DOUBTFUL SPECIES.

Retelea? megalostomata, Hennig, 1894 (Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 39, pl. ii. figs. 41, 42, and fig. 24, p. 40), from Campanian of Balsberg and Karlshamn, may be a species of *Retenoa*.

Family FASCIGERIDÆ, d'Orbigny, em.

[See B.M. Cat. Jur. Bry. p. 166.]

DIAGNOSIS.

Cyclostomata Tubulata in which the zoœcia are simple, open tubes. They arise from a small cupuliform or discoid base (the *Pelagia* or *Defrancia* stage). The zoœcia are monomorphic and very long. The zoarium consists of bundles of parallel zoœcia, and the apertures are in groups at the ends of the bundles.

AFFINITIES.

This family is first represented in the Jurassic System by two genera, *Fasciculipora* and *Apsendesia*. In *Fasciculipora* the zoarium consists of branching zoœcial bundles, which keep apart, so that the zoarium is open and dendroid. In *Apsendesia* the bundles arise from a small fungiform base, and are arranged in long linear series. The family becomes more important in the Cretaceous System, and d'Orbigny included thirteen genera in it; of these, however, five genera, viz., *Cyrtopora*, *Osculipora*, *Filifascigera*, *Multifascigera*, and *Lopholepis*, are here referred to the family Osculiporidæ, which was founded by Marsson.

Radiofascigera is either a confluent *Actinopora* or more probably one of the Osculiporidæ (*vide* p. 52). *Defrancia*, Bronn, is a synonym of *Apsendesia*.[1]

The family is nearly allied to the Osculiporidæ, in which the apertures are in groups on the sides of the branches instead of being all terminal.

DISCOFASCIGERA, d'Orbigny, 1853.

[Bry. Crét. p. 674.]

SYNONYMS.

Discofascigera, Pergens, 1890; Ulrich, 1900.
Lichenopora, *pars*, Vine, 1889.
Defrancia, *pars*, Waters, 1884.
Pelagia, *pars*, von Reuss, 1866.
Discotubigera, *pars*, Manzoni, 1877.
Umbrellina (*non* von Reuss), Vine, 1889.
Supercytis, Macgillivray, 1895.

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[1] Gregory. B.M. Cat. Jur. Bry. pp. 170, 171.

DIAGNOSIS.

Fascigeridæ in which the zoarium consists of a single, unbranched bundle of zoœcia; the zoœcia are short, and the zoarium is fungiform, consisting of a short stalk, which rapidly expands above into a circular or subcircular disc, with a convex upper surface.

Apertures crowded, and all on the upper surface of the zoarium; they are either irregular or sub-quincuncial in arrangement.

TYPE SPECIES.

Discofascigera ligeriensis, d'Orbigny. Senonian: France.

AFFINITIES.

The zoarium has a similar form to that of the *Defrancia* stage of *Apsendesia*, which differs by the arrangement of the apertures in radial lines or ridges. The genus is allied to *Fasciculipora*, which differs by having a branching tufted zoarium.

The genus was merged as a synonym of *Defrancia* by Busk,[1] who accepted d'Orbigny's species, *D. cupula*, as a form of the *Defrancia lucernaria* (Sars)[2]; but Sars' species has its apertures along radial ridges, and thus differs from d'Orbigny's two Cretaceous species. The two Bryozoa may, therefore, be quite distinct. Hamm[3] reduced *Discofascigera* to a synonym of *Fasciculipora*.

The genus appears to me a convenient one. It survives into the Cainozoic, and is represented in the Middle Cainozoic deposits of Australia by a *Discofascigera exaltata* (Waters),[4] from Mount Gambier in the State of South Australia; by *D. brendolensis* (Waters),[5] from the Miocene of Northern Italy, and also from the Miocene of Austria.[6]

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[1] Busk. Cat. Mar. Polyz. B.M. pt. iii. (1875), p. 36.

[2] *Tubulipora lucernaria*, M. Sars. "Beretning om en i Sommeren 1849 foretagen zoologisk Reise i Lofoten og Finmarken": Nyt. Mag. Nat. vol. vi. (1851), p. 145. *Defrancia lucernaria*, Sars, 1863. "Beskrivelse over nogle norske Polyzoer": Forh. Vid. Selsk. Christiania, Aar 1862 (1863), p. 164.

[3] Hamm. Bry. mastr. Ob.-Sen. i., Cycl. p. 35.

[4] *Defrancia exaltata*, A. W. Waters. Foss. Bry. Australia: Quart. Journ. Geol. Soc. vol. xl. (1884), p. 692, pl. xxxi. fig. 23.

[5] *Defrancia brendolensis*, A. W. Waters. N. Ital. Bry. pt. ii., Cycl.: *ibid.* vol. xlviii. (1892), p. 161, pl. iii. figs. 2–4.

[6] *E.g. Discotubigera actinoides*, Manzoni. Brioz. foss. Mioc. Austr. ed Ungh.: Denk. Akad. Wiss. Wien, vol. xxxviii. pt. ii. (1878), p. 17, pl. xvi. fig. 65.

The *Supercytis* of Macgillivray,[1] from the Middle Cainozoic of Victoria and South Australia, is a *Discofascigera*, as the apertures are terminal and not spread over the front surface of the zoarium.

1. **Discofascigera vinei,** Gregory, 1909.

Synonymy.

Lichenopora compressa (*non* d'Orb.), Vine, 1889. Further on Polyz. Camb. Greensd. pt. ii.: Proc. Yorks. Geol. Soc. new ser. vol. xi. p. 270, pl. xii. figs. 11, 12.

Discofascigera vinei, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. 5, vol. vi. p. 61.

Diagnosis.

Zoarium small, with a short pointed base, covered by epizoarium. The upper surface is flat, with small raised marginal projections. In young zoaria the apertures are sparse and widely scattered.

Dimensions.

		D. 1863.
Diameter of the zoarium	...	2 × 1·75 mm.
Height of the zoarium	...	1·6 ,,
Height of the base ...	...	·8 ,,
Diameter of the zoœcia	...	·1–·15 ,,

Distribution.

Albian—Cambridge Greensand: Cambridge.

Figures.

Pl. IV. Fig. 6. A zoarium of which the upper surface has been figured by Vine as "*Lichenopora compressa*?"; × 10 dia. Jesson Coll. **D. 1863.**

Affinities.

This species is characterized by the tooth-like elevations on the upper surface, which give it somewhat the appearance of *Discocytis*; but the irregular distribution of the apertures on the upper surface (as shown in Vine's figure, *op. cit.* fig. 12) is quite different from the arrangement in *Discocytis*, where (as illustrated, for example, in *D. esseniensis*, Sim., Bry. Essen. Grüns.: Verh. nat. Ver. preuss. Rheinl. u. Westph. vol. xxviii. (1871), pl. iii. fig. 2*d*) the apertures open on the outer margin at the ends of bundles, which project as ridges across the solid upper surface of the zoarium.

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[1] P. H. Macgillivray. Mon. Tert. Polyz. Vict.: Trans. R. Soc. Vict. vol. iv. (1895), p. 145, pl. xxii. figs. 1, 2.

D. 1863. The zoarium figured by Vine as "*Lichenopora compressa?*" Cambridge Greensand. Cambridge. Jesson Coll. Figd. Pl. IV. Fig. 6.

2. Discofascigera paucipora (Vine), 1884.

SYNONYMY.

Lichenopora paucipora, Vine, 1884. Cret. Lich.: Quart. Journ. Geol. Soc. vol. xl. p. 853, fig. 2.
,, ? ,, Vine, 1885. Camb. Greensd.: Proc. Yorks. Geol. Soc. new ser. vol. ix. p. 20.
Umbrellina ,, Vine, 1889. Further on Camb. Greensd.: *ibid.* vol. xi. p. 270.
Lichenopora radiata? (Aud.), Vine, 1885. Camb. Greensd.: Proc. Yorks. Geol. Soc. new ser. vol. ix. p. 20.
,, ,, ? Vine, 1889. Further on Camb. Greensd.: *ibid.* vol. xi. p. 271.

DIAGNOSIS.

Zoarium small. Shape somewhat fungiform, being composed of a flat horizontal disc, supported on a very short stem. The upper surface of the disc is slightly concave. The stem tapers to a blunt point; it is marked by about ten coarse irregular ridges, which increase to about thirty in number on the under side of the disc.

Apertures in vertical series of two or three, one above the other, around the margin of the upper part of the zoarium; about fifteen vertical series.

DIMENSIONS.

	D. 1857.	The type-specimen. D. 1874.	D. 1864.
	mm.	mm.	mm.
Diameter of zoarium ...	2·5 × 2·3	1·75	2·5
Diameter of stem	about ·5	—	about 1·25
Height of zoarium	—	about 1	over 2

DISTRIBUTION.

Albian—Cambridge Greensand: Cambridge. (Recorded by Vine, 1884, p. 854, as "Neocomian. Unknown.")

FIGURES.

Pl. IV. Fig. 5. Specimen from the Jesson Coll. Fig. 5*a*, the zoarium from above; × 12 dia. Fig. 5*b*, section across the base of the head of the same specimen, showing the character and arrangement of the zoœcia; × 12 dia. **D. 1857.**

Pl. VII. Fig. 3. Another specimen from the Jesson Coll. Fig. 3*a*, from above; × 8 dia. Fig. 3*b*, from the side; × 8 dia. **D. 1864.**

AFFINITIES.

This small species was described by Vine from specimens obtained from P. M. Duncan. It differs from *D. vinei* by the larger number and greater regularity of the vertical series of apertures round the margin of the disc, the shortness of the stem, and the fungiform shape of the zoarium. The upper surface was figured by Vine in 1884 and resembles a *Berenicea*, from which it differs by the fasciculate structure of the zoarium.

Vine remarked (1889, *op. cit.* p. 270), "there is no species in the whole of the Cambridge collection that I have had more bother with than the above." The trouble was no doubt largely due to the scarcity and imperfection of the material. I know it only by six small specimens, and in the first volume of the Catalogue (p. 281) I referred to the species as a larval fasciculate form. That conclusion I still accept, and *Discofascigera* appears to be the safest genus in which to include it. A doubt, however, as to this conclusion is suggested by the specimen (**D. 1864**) figured on Pl. VII. Fig. 3. The specimen from above (Fig. 3*a*) appears to agree in all essentials with **D. 1857**, figured on Pl. IV. Figs. 5*a*, *b*; and the section across the lower side of **D. 1857** agrees in structure with a simple *Discofascigera*. But the view of **D. 1864** from the side (Pl. VII. Fig. 3*b*) shows that the apertures tend to become serial as in a *Domopora*, or in *Trochiliopora humei*; and it is therefore possible that this species, *D. paucipora*, marks the departure of *Trochiliopora* and its allies with serial apertures from the simpler plan of *Discofascigera*. The serial arrangement in **D. 1864** is, however, not clearly shown all around the zoarium, as the specimen is not well preserved.

Vine identified two specimens (**D. 1864** and **D. 1865**) of this species as belonging to the recent Mediterranean *Melobesia radiata* of Audouin.

LIST OF SPECIMENS.

D. 1874. Three zoaria on a slide. This is the type-specimen figured by Vine in 1884. Cambridge Greensand. Cambridge. Jesson Coll.

D. 1857. A zoarium recorded by Vine as *Lichenopora* sp. Cambridge Greensand. Cambridge. Jesson Coll. Figd. Vol. II. Pl. IV. Figs. 5*a*, *b*.

D. 1864. A zoarium identified by Vine as *L. radiata* (Aud.). Cambridge Greensand. Cambridge. Jesson Coll. Figd. Pl. VII. Figs. 3*a*, *b*.

D. 1865. A zoarium identified by Vine as *L. radiata* (Aud.). Cambridge Greensand. Cambridge. Jesson Coll.

3. **Discofascigera ligeriensis**, d'Orbigny, 1853.

SYNONYMY.

Discofascigera ligeriensis, d'Orbigny, 1853. Bry. Crét. p. 675, pl. 743, figs. 4–7.
,, ,, Pergens, 1890. Rev. p. 378.

DIAGNOSIS.

Zoarium with the disc subcircular or irregularly elliptical in shape, and the upper surface tumid. The apertures are arranged irregularly. The lower surface is covered by a dense epizoarial layer, which may be marked by horizontal annular lines.

DIMENSIONS.

	D'Orbigny's type.	B.M. D. 3278.
Height of zoarium ...	1·5 mm.[1] ...	1·7 mm.
Diameter of zoarium ...	2–3 ,, ...	2·4 ,,
Diameter of apertures ...	·13 ,, [1] ...	·1–·12 ,,

DISTRIBUTION.

BRITISH:

Upper Chalk: between Black Head and Gobbin, Magee Island; Ballytoben and Whitewell, North-East Ireland.

FOREIGN:

Senonian—Coniacian: Varennes and Vendôme, Loir-et-Cher.

FIGURES.

Pl. IV. Fig. 4. A zoarium from the side; × 10 dia. Upper Chalk: Magee Island, Ireland. Presented by J. Wright, Esq., F.G.S. **D. 3278.**

AFFINITIES.

The Irish specimens have a smooth and the French a horizontally wrinkled epizoarial layer over the lower surface.

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[1] Estimated from d'Orbigny's figures.

LIST OF SPECIMENS.

D. 3278. A small zoarium. From Chalk powder. Between Black Head and Gobbin, Magee Island. Presented by J. Wright, Esq., F.G.S. Figd. Pl. IV. Fig. 4.

D. 3264. A broken zoarium. From Chalk powder. Ballytoben. Presented by J. Wright, Esq., F.G.S.

D. 3265. A complete zoarium. From Chalk powder. Whitewell, North-East Ireland. Presented by J. Wright, Esq., F.G.S.

D. 3263. Two fragments of zoaria. From Chalk powder. Ballytoben. Presented by J. Wright, Esq., F.G.S.

UNREPRESENTED SPECIES.

radiata, d'Orbigny, 1853.

Syn. *Discofascigera radiata*, d'Orbigny, 1853. Bry. Crét. p. 676, pl. 743, figs. 8–11.
,, ,, Pergens, 1890. Rev. p. 378.

Char.—Zoarium with depressed upper surface; under surface marked by longitudinal striæ; no epizoarium. Apertures regularly arranged in rings around a central zoœcium; the outer apertures are arranged somewhat quincuncially.[1]

Distrib.—Senonian—Campanian: Meudon, near Paris.
Coniacian: Fécamp, Seine-Inférieure.

FASCICULIPORA, d'Orbigny, 1846.

[Voy. Amér. Mér. vol. v. pt. iv. (1846), Polyp. Zooph. p. 20.]

Synonyms.

Fasciculipora, Busk, 1875; Hamm, 1881; Macgillivray, 1895; *pars*, Ulrich, 1900, etc.
Fungella, *pars*, von Hagenow, 1851; *pars*, Busk, 1859, etc.
Frondipora, *pars*, von Hagenow, 1846.

Diagnosis.

Fascigeridæ with a zoarium of long branches, which may be simple or branch into a dendroid, stipitate zoarium. The capitulum is simple or lobed. The branches are cylindrical and may be clavate.

The sides may be covered by a thick epizoarium, or marked by interzoœcial striæ or grooves.

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[1] In d'Orbigny's figure the apertures of the outermost ring appear as a circle of long, slit-like depressions, the shape of which is probably due to the upper surface having been worn down.

TYPE SPECIES.

Fasciculipora ramosa, d'Orbigny, 1846[1]: Voy. Amér. Mér. vol. v. pt. iv., Polyp. p. 20, pl. ix. figs. 22–4. Recent: Patagonia.

AFFINITIES.

The *Fungella* of von Hagenow was included by d'Orbigny partly in his *Fasciculipora* and partly in his *Corymbopora.* The type species of *Fungella* is a capitate *Heteropora.* The genus occurs in the Middle Cainozoic deposits of Bairnsdale, Victoria.

1. **Fasciculipora neocomiensis** (d'Orbigny), 1853.

SYNONYMY.

Corymbosa neocomiensis, d'Orbigny, 1853. Bry. Crét. p. 690, pl. 783, figs. 20–3.
Fasciculipora ,, Pergens, 1890. Rev. p. 377.
? ,, ,, Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 512.
,, ,, Canu, 1902. Bry. foss. i., Coll. Camp.: Bull. Soc. géol. France, ser. 4, vol. ii. p. 11.

DIAGNOSIS.

Zoarium of long, regularly cylindrical, dichotomous branches, with about thirty-two zoœcia in each. The ends of the branches are pointed and the sides fluted.

DISTRIBUTION.

Neocomian: Sainte-Croix, Vaud.
? Senonian: Rouen (*fide* Pergens and Bucaille).

AFFINITIES.

The position, characters, and distribution of this species have all been subject to considerable uncertainty. D'Orbigny in his enlarged figure of his type-specimen represents it as bearing biserial lateral pores; and if these structures were present, the species could not be included in *Fasciculipora,* to which it was transferred by M. Pergens. Doubt as to the existence of the pores is suggested by d'Orbigny's own figures, as his fig. 21 does not show them, though the figure which does is only magnified about twice as much as fig. 21.

Fortunately, there is a specimen in the collection which is no doubt the same species. It comes from a Swiss Neocomian locality, of which the name on the label is illegible. The specimen is much branched, is 22 mm. long, and agrees in all respects with d'Orbigny's fig. 21.

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[1] D'Orbigny states that the plate with the name was published in 1839. The text appeared either in 1846 or perhaps 1847.

The species is Neocomian, but has been quoted from the Senonian by Pergens and Bucaille.

D. 3709. A branched zoarium. Neocomian. Switzerland. (Loc. illegible, but resembles "Nogeans.") Old Coll.

2. **Fasciculipora prolifera** (von Hagenow), 1851.

SYNONYMY.

Fungella prolifera, von Hagenow, 1851. Bry. maastr. Kr. p. 37, pl. iii. fig. 6.
" " d'Orbigny, 1853. Bry. Crét. p. 668.
" " Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 213.
Defrancia " Schlüter, 1870. Geogn. Pal. Reise südl. Schweden: N. Jahrb. 1870, p. 940.
Fasciculipora prolifera, *pars*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 45.
" *incrassata*, d'Orbigny, 1853. Bry. Crét. p. 670, pl. 742, figs. 16–18.
" " Pergens, 1890. Rev. p. 377.

DIAGNOSIS.

Zoarium attached by a rounded foot. Young forms are simple, sub-conical, and sub-piriform. Older zoaria are lobed, and the lobes grow outwards into a series of short, blunt bundles, which are free laterally.

Outer surface with faint longitudinal striæ.

DIMENSIONS.

	Von Hagenow's type.	D'Orbigny's specimen.
Height of zoarium ...	5 mm. ...	10 mm.
Diameter of zoarium ...	5·5 " ...	10 "
Branches	2 " ...	2 "
Diameter of apertures ...	·1 " ...	about ·1 mm.

DISTRIBUTION.

Senonian—Maastrichtian: Maastricht; Sainte-Colombe, Manche; South Sweden (*fide* Schlüter).
Campanian: Ciply; Meudon, near Paris.

AFFINITIES.

The inclusion of *Plethopora verrucosa*, Hag., in this species was suggested by Hamm; but the two species seem to me distinct; for in *P. verrucosa* the apertures are in groups, some of which are on the side of the zoarium, and the sides are apparently cancellate.

LIST OF SPECIMENS.

D. 1393. Two fragments (on slide). The apertures are ·25 mm. in diameter. Maastrichter Kalk. Maastricht. G. R. Vine Coll.

30,746. Two small tufts, with the heads somewhat vase-shaped. Campanian. Ciply. Hottelart Coll.

3. **Fasciculipora plicata** (von Hagenow), 1851.

SYNONYMY.

Fungella plicata, von Hagenow, 1851. Bry. maastr. Kr. p. 37, pl. iii. fig. 7.
Fasciculipora plicata, d'Orbigny, 1853. Bry. Crét. p. 668.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 35.

DIAGNOSIS.

Zoarium simple, unlobed, and sub-piriform. The sides are marked above by faint vertical grooves, which gradually disappear beneath the thick epizoarial layer.

Apertures rounded or angular, being sometimes rectangular and sometimes pentagonal.

DIMENSIONS.

		mm.
Height of zoarium	...	3·5
Diameter of zoarium	...	3 × 3·5
Diameter of apertures	...	·13–·16

DISTRIBUTION.

Senonian—Maastrichtian: Maastricht.

D. 3503. A specimen with thick lateral epizoarium (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

4. **Fasciculipora cretacea,** d'Orbigny, 1850.

SYNONYMY.

Fasciculipora cretacea, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 268.
,, ,, d'Orbigny, 1853. Bry. Crét. p. 670, pl. 742, figs. 13–15.
,, ,, Pergens, 1890. Rev. p. 377.
,, ,, Gamble, 1896. Cat. Bry. Chatham, p. 7.

DIAGNOSIS.

Zoarium of long, narrow, dichotomous branches, which are widely open. The branches are expanded at their distal ends.

The stems are marked by distinct raised lines, which are slightly sinuous.

About 16 to 20 zoœcia in each stem.

DIMENSIONS.

			mm.
Height of zoarium	...	...	9
Width of zoarium	...	...	14
Diameter of stems	...	...	·6–1
Diameter of apertures	...	...	·1–·15

DISTRIBUTION.

BRITISH :

Upper Chalk—Zone of *Micraster coranguinum* : Gravesend.
Middle Chalk—Zone of *M. cortestudinarium* : Chatham.

FOREIGN :

Senonian—Coniacian : Fécamp, Seine-Inférieure.

FIGURES.

Pl. IV. Fig. 3*a*. A zoarium ; natural size. Fig. 3*b*, end of one branch of the same specimen ; × 15 dia. Upper Chalk : Gravesend. Bowerbank Coll. **D. 2611.**

AFFINITIES.

Fasciculipora pinnata (d'Orb.) may be the young stage of this species (see p. 42).

LIST OF SPECIMENS.

D. 2611. A large zoarium in chalk. Upper Chalk. Gravesend. Bowerbank Coll. Figd. Pl. IV. Figs. 3*a*, *b*.

D. 2749. A fragment (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. G. R. Vine Coll.

D. 4168. A fragment (on flint). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

5. **Fasciculipora spicata,** Gregory, 1909.

SYNONYMY.

Fasciculipora spicata, Gregory, 1909. New Cret. Bry. : Geol. Mag. dec. 5, vol. vi. p. 61.

DIAGNOSIS.

Zoarium with a narrow stem, widening into a thick horizontal expansion, from which rise numerous short, blunt fasciculi. The zoarium seen from above is roughly triangular.

The head includes about ten bundles of zoœcia, which rise upward in sharp spikes. The bundles are grooved longitudinally and branch dichotomously ; the sides when worn appear punctate, but in well-preserved specimens are marked with longitudinal ridges, decorated by small tubercles.

DIMENSIONS.

	D. 7283. mm.	30,746. mm.
Height of zoarium	6 ...	6
Length of the head	7 ...	6
Maximum width of the head ...	3 ...	6
Diameter of the stem	1·5 × 2·5 ...	1·6

DISTRIBUTION.

BRITISH :

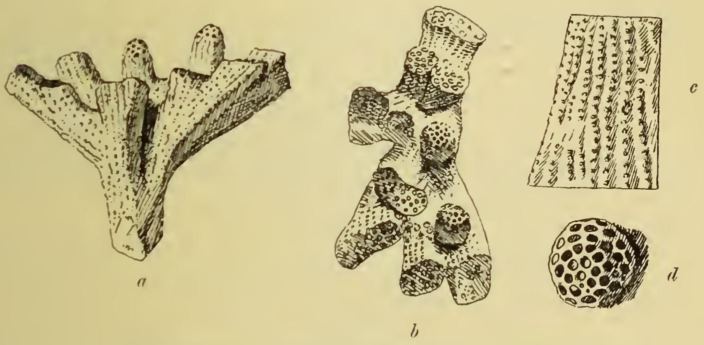
Chalk : south-east of England.

FOREIGN :

Senonian—Campanian : Ciply.

FIGURES.

Fig. 17*a*. The type-specimen from the side ; × 5 dia. Fig. 17*b*, the same from above ; × 5 dia. Fig. 17*c*, part of the side of the zoarium, showing the longitudinal ribs ; × 10 dia. Fig. 17*d*, the upper surface of a spike with the end preserved ; × 10 dia. Chalk : south-east of England. **D. 7283.**



FIGS. 17*a–d*.—*Fasciculipora spicata*. **D. 7283.**

Pl. VI. Fig. 7*a*. A zoarium from the side ; × 5 dia. Fig. 7*b*, the same from above ; × 5 dia. Fig. 7*c*, part of the worn side of the zoarium, showing the tubercles ; × 10 dia. Fig. 7*d*, the end of a spike seen from above ; × 10 dia. Senonian—Campanian : Ciply. Hottelart Coll. **D. 11,801.**

AFFINITIES.

This species is most nearly allied to *F. cretacea*, d'Orb., with which it agrees in the thickness of the fasciculi and in the ornamentation of the sides. It differs, however, by growth into a flat head, whence rise numerous short, blunt fasciculi, instead of by growth into a dendroid zoarium. This character gives it somewhat the aspect of a *Discocytis*.

LIST OF SPECIMENS.

British.

D. 7283. The type-specimen. Chalk. Loc.? Toulmin Smith Coll. Figd. Nos. 17*a–d*, p. 41.

Foreign.

D. 11,801. A zoarium with broken base. Senonian — Campanian. Ciply. Hottelart Coll. Figd. Pl. VI. Figs. 7*a–d*.

UNREPRESENTED SPECIES.

1. ? aspera, von Reuss, 1874.

Syn. *Fasciculipora aspera*, von Reuss, 1874. Bry. ob. Plän.: Palæontogr. vol. xx. pt. ii. p. 135, pl. xxv. fig. 9.

Distrib.—Cenomanian—Pläner: Strehlen, Saxony.

Aff.—Generically indet.

2. flabellata, d'Orbigny, 1853.

Syn. *Fasciculipora flabellata*, d'Orbigny, 1853. Bry. Crét. p. 669, pl. 783, figs. 8–11.

,, ,, Canu, 1902. Bry. foss. i., Coll. Camp.: Bull. Soc. géol. France, ser. 4, vol. ii. p. 11.

Char.—Zoarium of short, laterally compressed branches from 3 to 4 mm. in dia.; they remain attached laterally. Zoœcia from twenty-five to fifty in each bundle. External walls with faint longitudinal ridges.

Distrib.—Neocomian: Sainte-Croix, Vaud.

3. pinnata (d'Orbigny), 1853.

Syn. *Clavisparsa pinnata*, d'Orbigny, 1853. Bry. Crét. p. 776, pl. 753, figs. 11, 12.

Char.—Zoarium short, unbranched, and clavate; it is 2 mm. in dia., 7 mm. high, and the apertures are large, being about ·4 mm. across (*fide* d'Orbigny's figure). Surface marked by faint longitudinal grooves.

Distrib.—Senonian—Coniacian: Joué, Indre-et-Loire.

Aff.—Possibly the young stage of *F. cretacea*. The stem has the same conical termination, but the zoœcia are wider than in *F. cretacea*; for if d'Orbigny's two figures may be trusted, the larger one is magnified about ten diameters and the zoœcia would be ·4 mm. in transverse diameter, and would therefore be twice as wide as those of *F. pinnata*.

4. reticulata, d'Orbigny, 1853.

Syn. *Fasciculipora reticulata*, d'Orbigny, 1853. Bry. Crét. p. 669, pl. 742, figs. 10–12.

non ,, ,, Gamble, 1896. Cat. Bry. Chatham, p. 7.

Char.—Zoarium of very short, low branches, which are thick and laterally compressed. The branches are 3 mm. in dia. The base is broad, and there is no constricted peduncle. About forty to fifty zoœcia in each group.

Distrib.—Cenomanian: Le Mans.

APSENDESIA,[1] Lamouroux, 1821.

[Expos. Méth. p. 81.]

SYNONYMS.

Pelagia, Lamouroux, 1821 : d'Orbigny, 1849.
Defrancia, *pars*, Bronn, 1848.
Discotubigera, Vine, 1888.
non Apsendesia, Hennig, 1894.

DIAGNOSIS.

Fascigeridæ with a massive zoarium, which develops from a small cup-shaped disc. The zoœcial groups in the adult are long, and form irregularly sinuous series, which may be so crowded that the zoarium becomes massive.

Apertures all on the ends of the zoœcial bundles.

TYPE SPECIES.

Apsendesia cristata, Lamouroux, 1821. Jurassic—Bathonian: England, France, and Germany.

UNREPRESENTED SPECIES.

1. **neocomiensis**, d'Orbigny, 1850.

SYN. *Apsendesia neocomiensis*, d'Orbigny, 1850. Prod. Pal. ii. p. 87.
,, ,, d'Orbigny, 1853. Bry. Crét. p. 683, pl. 743, figs. 12–14.

CHAR.—Zoarium nodular, with the bundles of zoœcia arranged in sinuous series, which give the zoarium a meandriform aspect. The bundles of zoœcia are somewhat regular, and occur as elliptical or triangular groups, which project on the obverse side of the erect sinuous lamina, of which the reverse side is covered by thick epizoarium.

DISTRIB.—Neocomian: Fontenoy, Yonne.

2. **harmeri**, Pergens, 1894.

SYN. *Apsendesia harmeri*, Pergens, 1894. Nouv. Bry. Crét. Limb.: Bull. Soc. belge Géol. vol. vii., Mém. p. 176, pl. viii. fig. 3.

CHAR.—Zoarium elliptical in section, with a considerable number of radial ridges, around a long central depression, the floor of which is imperforate. The apertures open along the top of the ridges and they are biserial, or rarely triserial; each longitudinal row includes from two to eight apertures. Zoarium in the type-specimen 9 mm. long by 4·5 mm. wide, and with a little over thirty radial groups of apertures.

DISTRIB.—Senonian—Maastrichtian: Fauquemont, Limburg.

AFF.—This species is a young *Apsendesia* which agrees with the typical Jurassic species by the simple cup-shaped form of the zoarium; it appears, however, to be adnate. From the Neocomian species *A. neocomiensis*, d'Orb.,[1] it differs by the simple form of its zoarium; in the Neocomian species the zoarium is massive and somewhat meandriform.

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[1] In reference to the spelling of *Apseudesia* sometimes adopted, *v.* footnote, B.M. Cat. Jur. Bry. p. 168.

CORYMBOPORA, Michelin, 1846.

[Icon. Zooph. p. 213.]

SYNONYMS.

Corymbosa, d'Orbigny, 1853.
Fasciculipora, *pars*, d'Orbigny, 1850; Pergens, 1890.
Fungella, *pars*, von Hagenow, 1851.

DIAGNOSIS.

Fascigeridæ with simple or branched zoarium. The distal end or ends are always expanded, and either flat-topped, concave, or convex. The middle of the upper surface is occupied by crowded, irregular, young zoœcia. On the margin there is a band of larger zoœcia. The sides of the stem are covered by an epizoarial layer, marked by numerous pores, the remnants of the apertures of dead zoœcia.

TYPE SPECIES.

Corymbopora menardi, Michelin, 1846. Icon. Zooph. p. 213, pl. liii. fig. 10. Cenomanian: Le Mans, France.

AFFINITIES.

The main problem in regard to *Corymbopora* is the nature of the lateral pores on the stem. D'Orbigny at first regarded them as insignificant, and therefore in 1850 treated the genus as a synonym of *Fasciculipora*, a view still held by Pergens. D'Orbigny, however, subsequently regarded the stem pores as more important, and accepted *Corymbopora*. The pores seem to be due to the nearly complete filling of the apertures of the dead zoaria by epizoarial material. The genus differs from *Fasciculipora* by the expanded or clavate ends of the branches.

Smitt[2] has used this genus as the type of a family—the Corymboporidæ.

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[1] D'Orbigny. Bry. Crét. p. 683, pl. 743, figs. 12–14.

[2] F. A. Smitt. Kritisk förteckning öfver Skandinaviens Hafsbryozoer: Öfvers. k. Vet. Akad. Förh. 1865, p. 407. Bryozoa marina in regionibus arcticis et borealibus viventia: *ibid.* 1867, p. 447.

Corymbopora menardi, Michelin, 1845.

SYNONYMY.

Corymbopora menardi,	Michelin, 1845.	Icon. Zooph. p. 213, pl. liii. fig. 10.
Corymbosa ,,	d'Orbigny, 1853.	Bry. Crét. p. 691, pl. 744, figs. 7–12.
Fasciculipora ,,	d'Orbigny, 1850.	Prod. Pal. vol. ii. p. 177.
,, ,,	Pergens, 1890.	Rev. p. 377.

DIAGNOSIS.

Zoarium branched and arborescent, of club-shaped, compressed branches, which dichotomize irregularly. The ends of the branches are flat. The apertures are crowded, and irregularly quincuncial in arrangement.

The sides of the branches are marked by longitudinal ridges, between which are the numerous oval pores.

DISTRIBUTION.

Cenomanian: Le Mans, Sarthe.

D. 1285. A zoarium and two fragments (on slide). Cenomanian. Le Mans. G. R. Vine Coll.

UNREPRESENTED SPECIES.

bohemica (Počta), 1892.

SYN. *Fasciculipora bohemica*, Počta, 1892. Mech. Koryc. Hory: Ces. Akad. Fr. Jos. Praze, sect. ii. pp. 27, 33, pl. iii. figs. 21–30.

CHAR.—Zoarium irregularly funnel-shaped, with a slightly expanded base, and the stem curved or straight. It is up to 5 mm. high and 7 mm. in diameter above. It expands above into a broad subcircular head, with a central depression. The apertures are irregularly scattered, small, and crowded. Larger on the margin; linear faint vertical series on the stem. Marginal apertures ·15 to ·3 mm. in diameter. Some of the small ones are placed in the angles between the larger. Zoœcia usually between ·15 and ·2 mm. in diameter.

DISTRIB.—Cenomanian—Korycaner Schichten: Kank, Bohemia.

AFF.—The zoarium of this species gives it an apparent resemblance to *Fungella dujardini*, but with an irregularly obconic instead of club-shaped zoarium. It differs from *Fungella*, however, in the absence of mesopores; for the instructive longitudinal section published by Počta (*op. cit.* pl. iii. fig. 27) shows that the zoœcia are monomorphic, so that the apparent mesopores are only sections across young zoœcia. The species may be regarded as a *Corymbopora* with a simple, unbranched zoarium.

NOTE ON SOME CAPITATE GENERA.

The Cretaceous Bryozoa include an interesting series of forms which are fungiform, capitate, or clavate, having a narrow cylindrical stem that expands upward into a fungus-shaped cap, or into a disc, or into a club-shaped knob.

These Bryozoa would all be closely associated in any classification based on zoarial growth alone; but the structure of these forms is so different that they must be widely separated. It may be convenient, however, to tabulate the genera and their affinities.

CORYMBOPORA, Michelin, 1846 (= *Corymbosa*, d'Orbigny, 1853).

Type species, *C. menardi*, Mich.

Fascigeridæ with zoaria of dichotomous cylindrical stems with expanded ends. Monomorphic. Pores on sides of branches left by the nearly filled up apertures of dead zoœcia.

BICAVEA, d'Orbigny, 1853.

Type species, *B. urnula* (d'Orb.).

Osculiporidæ with a capitate zoarium, with a short narrow stem and a series of tooth-like projections from the upper margin of the zoarium.

FUNGELLA, von Hagenow, 1851.

Type species, *F. dujardini* (Hag.).

No one having previously selected one of von Hagenow's three species as the type, I select *F. dujardini*, as that seems to agree most fully with von Hagenow's diagnosis. That species has a simple clavate zoarium, which is dimorphic. The British Museum specimens show (cf. e.g. Pl. VII. Fig. 2*b*) that the apertures are irregularly arranged.

Fungella belongs to the family Cresciscidæ. The genus is a close ally of *Heteropora*, differing from it by the simple clavate form of the zoarium.

TROCHILIOPORA, Gregory, 1909.

Type species, *T. humei*, Gregory, 1909.

Radioporidæ. The genus has a capitate zoarium and is closely allied to *Domopora* and *Discocavea*.

Family OSCULIPORIDÆ.

SYNONYMS.

Osculiporidæ, Marsson, 1887.
Fasciculiporidæ, Pergens & Meunier, 1887.
Fascigeridæ, *pars*, d'Orbigny, 1853.
Cytisidæ, d'Orbigny, 1854.
Frondiporidæ, *pars*, Vine, 1885.

DIAGNOSIS.

Cyclostomata Tubulata with simple tubular zoœcia. The zoœcia are monomorphic and long. They occur in bundles, and the apertures open in clusters on the sides or surface of the zoarium. Zoarium encrusting, cylindrical, or dendroid.

AFFINITIES.

This family begins in the Weisser Jura of Wurtemberg, but is first well developed in the Cretaceous, after which it gradually becomes less important.

The Osculiporidæ are allied to the Theonoidæ, but differ by the apertures being in groups and not in linear series. The zoarium is an encrusting band in *Filifascigera*, a simple and broad encrustation in *Lopholepis*, nodular and massive in *Multifascigera*, a compound group of radial tufts in *Radiofascigera*, and cylindrical in *Cyrtopora*.

The Osculiporidæ have a series of zoarial forms corresponding to the chief modifications in the simple Tubulata. Thus—

Filifascigera	corresponds to	*Proboscina*.
Lopholepis	,,	*Berenicea*.
Multifascigera	,,	*Reptomultisparsa*.
Cyrtopora	,,	*Entalophora*.

FILIFASCIGERA, d'Orbigny, 1853.

[Bry. Crét. p. 684.]

SYNONYMS.

Tubulipora, Lonsdale, 1844.
Obelia, Michelin, 1847.
Idmonea, d'Orbigny, 1850.
Seriefascigera, Hamm, 1881.
Lopholepis, Meunier & Pergens, 1885.

DIAGNOSIS.

Osculiporidæ with the zoarium encrusting; of creeping stolons, which may be simple or may branch. The zoœcia are grouped in bundles, and the apertures occur in clusters at intervals along the bands.

TYPE SPECIES.

Filifascigera megæra (Lonsdale), 1845. Senonian—Maastrichtian: New Jersey, U.S.A.

AFFINITIES.

The possibility of this genus being founded on the base of an Entalophorid was considered in this Catalogue (Vol. I. p. 249); but as that conclusion is not yet established, the genus has still to be retained. A fresh doubt was, however, introduced, for the Museum acquired two specimens from the Cretaceous of New Jersey, identified as the type species *F. megæra.* They are both Cheilostomata; if they were correctly determined, the three European species now included in the genus would be quite distinct from it.

This doubt has, however, been allayed by the excellent figures of the type species recently published by Stuart Weller, "A Report on the Cretaceous Palæontology of New Jersey," Geol. Surv. New Jersey, Palæont. vol. iv. (1907), p. 325, pl. xxii. figs. 12–15.

Filifascigera megæra (Lonsdale), 1845.

SYNONYMY.

Tubulipora megæra, Lonsdale, 1845. Polyp. Timber Ck.: Quart. Journ. Geol. Soc. vol. i. p. 69.
,, ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 266.
Filifascigera ,, d'Orbigny, 1853. Bry. Crét. p. 684.
,, ,, Gabb & Horn, 1862. Foss. Polyz. N. Amer.: Journ. Acad. Nat. Sci. Phil. ser. 2, vol. v. p. 165, pl. xxi. fig. 53.
,, ,, Ulrich, 1900. In Zittel—Eastman, Textbook Palæont. vol. i. p. 263, fig. 421.
,, ,, Weller, 1907. Cret. Pal. N. Jersey: Geol. Surv. N. Jersey, Palæont. vol. iv. p. 325, pl. xxii. figs. 12–15.

DIAGNOSIS.

Zoarium of thin stolons. Apertures in groups of two to five.

DISTRIBUTION.

Senonian: Rancocas division of New Jersey.
Maastrichtian: Timber Creek and Vincentown, New Jersey, U.S.A.

AFFINITIES.

This species is the type of the genus, but the early figures given of it were inadequate, and left its affinities doubtful. D'Orbigny and

Hamm have both adopted the genus for European species, and its characters have been confirmed by the excellent figures recently published by Weller.

?**D. 5379.** Two small specimens. Senonian — Maastrichtian. Vincentown, New Jersey. Ulrich Coll.

These specimens are certainly distinct from *Filifascigera megæra*, for they are fragments of Cheilostomata. They were entered here before the publication of Weller's figures showed that Lonsdale had correctly represented the essential characters of *Filifascigera*.

UNREPRESENTED SPECIES.

1. bohemica, Počta, 1892.

Syn. *Filifascigera bohemica*, Počta, 1892. Mech. Koryc. Hory: Ces. Akad. Fr. Jos. Praze, sect. ii. p. 26, pl. i. fig. 14.

Char.—Irregular zoarium of short fasciculi, each containing from five to seven zoœcia; the apertures are highly raised. The fasciculi are about 1 mm. long, about ·7 mm. wide, and ·4 mm. thick.

Distrib.—Cenomanian—Korycaner Schichten: Kank, Bohemia.

2. cellula, Hamm, 1881.

Syn. *Filifascigera cellula*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 35.

Char.—Zoarium of delicate, dichotomous branches. The bundles are long, slim, and club-shaped, and much drawn out at the proximal end. The apertures are in groups of five to seven, situated at the distal end of the bundles; the apertures are very small, thin-walled, close together, and slightly raised.

Distrib.—Senonian—Maastrichtian: Fauquemont, Maastricht.

3. dichotoma, d'Orbigny, 1853.

Syn. *Filifascigera dichotoma*, d'Orbigny, 1853. Bry. Crét. p. 685, pl. 744, figs. 1–3.

Char.—Zoarium of short, dichotomous stolons, which dichotomize after each group of apertures. Apertures, from two to four in each group. The aspect of the zoarium is like a thick *Stomatopora* with the simple apertures of that genus replaced by two or four apertures.

Distrib.—Senonian—Santonian: Saintes, Charente-Inférieure.
Coniacian: Vendôme, Loir-et-Cher.

Aff.—Resembles *F. megæra* in general appearance, but has shorter, thicker stolons.

4. irregularis, Hennig, 1894.

Syn. *Filifascigera irregularis*, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 28, pl. ii. fig. 29.

Char.—Zoarium of narrow, regular, dichotomous branches. Closely allied to *F. dichotoma*, but with the apertures often in transverse lines.

Distrib.—Senonian—Campanian: Balsberg, Sweden.

5. **repens** (Hamm), 1881.

Syn. *Seriefascigera repens*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 33.

Char.—Stolons dichotomous, branches flat and wide. Apertures well raised and in groups of from two to four. Zoœcia large.

Distrib.—Senonian—Maastrichtian: Fauquemont, Belgium.

LOPHOLEPIS, von Hagenow, 1851.

[Bry. maastr. Kr. p. 39.]

Synonyms.

Lopholepis, von Hagenow, 1851; d'Orbigny, 1853; *non* Sharpe, 1854.[1]
Theonoa, *pars*, Ulrich, 1900.

Diagnosis.

Osculiporidæ in which the zoarium is a broad incrustation, with the apertures at the ends of raised bundles of zoœcia, separated by a lower selvage, which contains neither apertures nor pores. The apertures in the bundles are crowded, quincuncial, or irregular, but not serial.

Type Species.

Lopholepis radians, von Hagenow, 1851. Bry. maastr. Kr. p. 39, pl. iii. figs. 11*a–c*, *h–k*. Senonian—Maastrichter Kalk: Maastricht.

Affinities.

This genus is characterized by its incrusting zoarium. It differs from *Actinopora*, as in that genus the apertures occur in radial lines; from *Cyrtopora*, as in that genus the zoarium grows in stems. *Lopholepis* has been recorded in England by Sharpe, whose *Lopholepis hagenowi* is, however, an *Idmonea* (B.M. Cat. Vol. I. p. 150).

1. **Lopholepis radians**, von Hagenow, 1851.

Synonymy.

Lopholepis radians, von Hagenow, 1851. Bry. maastr. Kr. p. 39, pl. iii. figs. 11*a–c*.
,, ,, d'Orbigny, 1853. Bry. Crét. p. 687.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 33.
Theonia ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 222.
Lopholepis irregularis, von Hagenow, 1851. Bry. maastr. Kr. p. 39, pl. iii. figs. 11*h–k*.
,, ,, d'Orbigny, 1853. Bry. Crét. p. 687.
Theonia ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 222.

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[1] Quart. Journ. Geol. Soc. vol. x. p. 196.

DIAGNOSIS.

Apertures grouped into somewhat elliptical series, which are irregularly scattered throughout the zoarium. The groups of apertures include up to about fifty apertures in a group.

DISTRIBUTION.

Senonian—Maastrichtian: Maastricht.

D. 6345. A zoarium of var. *irregularis* (on slide). Maastrichter Kalk. St. Pierre; Maastricht. Busk Coll. Presented by Miss Busk, 1899.

2. Lopholepis alternans, von Hagenow, 1851.

SYNONYMY.

Lopholepis alternans,		von Hagenow, 1851. Bry. maastr. Kr. p. 39, pl. iii. figs. 11*d*-*f*.
,,	,,	d'Orbigny, 1853. Bry. Crét. p. 687.
,,	,,	*pars*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 33.
Theonia	,,	Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 222.

DIAGNOSIS.

Groups of apertures in an irregular, alternate series. The groups of apertures are united at their inner ends to form a continuous series along the middle of the zoarium.

DISTRIBUTION.

Senonian—Maastrichter Kalk: Maastricht, Geulheim, ? Bemelen, Petit-Lanaye.

AFFINITIES.

This species may be only a variety of *Lopholepis radians*, Hag., formed by the growing together of the zoœcial bundles. Hamm keeps it distinct from *L. radians*, and places *L. irregularis* as a synonym, whereas it appears to me that *L. irregularis* more nearly resembles *L. radians* than *L. alternans*. Von Hagenow apparently originally regarded the three species as one, they having all been numbered fig. 11 on his plate.

LIST OF SPECIMENS.

D. 6343. Three broken zoaria (on slide). Maastrichter Kalk. Geulheim. Busk Coll. Presented by Miss Busk, 1899.

? D. 6346. A broken specimen, which may be one side of a specimen of this species; the other specimen on the same slide is a large compound *Actinopora diadema*. The slide is labelled by Busk *Lopholepis radians*. Maastrichter Kalk. Bemelen. Busk Coll. Presented by Miss Busk, 1899. *Vide antea*, p. 20.

D. 3467. A zoarium (in tube). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3737. A good specimen (on slide). Senonian — Maastrichtian. Petit-Lanaye, near Maastricht. Identified by M. Pergens. Gamble Coll.

UNREPRESENTED SPECIES.

rapax, Meunier & Pergens, 1885.

Syn. *Lopholepis rapax*, Meunier & Pergens, 1885. Nouv. Bry. Crét. Sup.: Ann. Soc. malac. Belg. vol. xx., Mém. p. 33, pl. ii. fig. 6.

Char.—Zoarium with four to six curved, well-raised fasciculi, containing from six to sixteen zoœcia in each. Zoarium 8–16 mm. long, 3 mm. high.

Distrib.—Senonian—Maastrichtian: *Stellocavea* bed, Fauquemont, Limburg.

? RADIOFASCIGERA, d'Orbigny, 1853.

[Bry. Crét. p. 681.]

Synonym.

Apsendesia, *pars*, Ulrich, 1900.

Diagnosis.

Zoarium dendroid, of sub-cylindrical dichotomous branches. It is composed of colonies, in each of which the zoœcial groups are radially arranged and form a broken circle of clusters.

Type Species.

R. ramosa, d'Orbigny, 1853. Neocomian: Switzerland.

UNREPRESENTED SPECIES.

ramosa, d'Orbigny, 1853.

Syn. *Radiofascigera ramosa*, d'Orbigny, 1853. Bry. Crét. p. 682, pl. 783, figs. 17–19.

,, *neocomiensis*, Canu, 1902. Bry. foss. i., Coll. Camp.: Bull. Soc. géol. France, ser. 4, vol. ii. p. 11.

Char.—Zoarium of branches 4 mm. in dia. Each sub-colony is about 3 mm. in dia. and has about ten radial groups of zoœcia, and each group has from twelve to twenty apertures.

Distrib.—Neocomian: Sainte-Croix, Vaud.

Aff.—There is no specimen of this genus in the collection. Its affinities seem to me doubtful. It may be a confluent group of *Actinopora*, in which the ridges are so short that the apertures tend to open in an elliptical or wedge-shaped sub-terminal group, as in *A. brongniarti* (M.-Edw.). If so, it may be included in *Multitubigera*. The zoarium as represented in d'Orbigny's figures is, however, Fascigeroid in aspect, so that the apparent affinities with *Multitubigera* may be misleading. M. Canu has remarked that d'Orbigny's figures are exaggerated.

CYRTOPORA, von Hagenow, 1851.

[Bry. maastr. Kr. p. 21.]

SYNONYMS.

Cyrtopora, von Hagenow, 1851; d'Orbigny, 1853; Winkler, 1864; Ubaghs, 1879; Hamm, 1881; Pergens, 1887, 1890; Ulrich, 1900.

DIAGNOSIS.

Osculiporidæ with erect cylindrical branches, with clusters of apertures opening on all sides of them.

TYPE SPECIES.

Cyrtopora elegans, von Hagenow, 1851. Bry. maastr. Kr. p. 22, pl. i. fig. 14.

AFFINITIES.

This genus corresponds among the Osculiporidæ to such a form as *Plethopora verrucosa*, Hag.,[1] among the Fasciporidæ; the latter differs by its cancellate zoarium, while the zoœcial groups are larger. *Cyrtopora* differs from *Fasciculipora* by having the groups of apertures on the sides of the branches instead of their being all terminal. It has somewhat the aspect of an *Entalophora*, but differs by the zoœcia being arranged in groups instead of singly.

Cyrtopora elegans, von Hagenow, 1851.

SYNONYMY.

Crytopora elegans, von Hagenow, 1851. Bry. maastr. Kr. p. 22, pl. i. fig. 14.
,, ,, d'Orbigny, 1853. Bry. Crét. p. 674, pl. 743, figs. 1-3.
,, ,, Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 214.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 58.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. p. 45.
,, ,, Pergens & Meunier, 1887. Bry. gar. Faxe: Ann. Soc. malac. Belg. vol. xxi., Mém. p. 222.
,, ,, Pergens, 1890. Rev. p. 377.

DIAGNOSIS.

Zoarium of cylindrical branches, which are simple or dichotomous, of moderate size, and contain many zoœcia. Branches thin, 2–3 mm. in diameter.

Apertures polygonal or round, situated on irregularly scattered, raised prominences, containing from three to eight apertures each.

Gonœcium an ovoid protuberance near the end of the zoarium.

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[1] Von Hagenow. Bry. maastr. Kr. 1851, p. 15, pl. v. fig. 10.

DIMENSIONS.

	Maastricht.	A young clavate zoarium. D. 3333. Fig. 18 in text.	Sections. D. 3326.	Part of a zoarium with gonœcium. D. 3327.
	mm.	mm.	mm.	mm.
Height of zoarium	—	7	2–2·5	—
Diameter of stem ...	2	1·6 above the base to 2·2 near the top.		2·4
Diameter of zoœcia	—	—	·1–·2	—
Diameter of aperture	·1–·2	·1	—	·1–·15
Gonœcium... ...	—	—	—	·5 wide × 1·5 long.

DISTRIBUTION.

Danian: Faxoe (*fide* Pergens & Meunier).
Senonian — Maastrichtian: Maastricht, Valkenberg, and Nedercanne, Limburg; Sainte-Colombe, Manche.

FIGURES.

Fig. 18. × 8 dia. **D. 3333.** A small, clavate zoarium, with slightly expanded base; Maastrichter Kalk: Maastricht. Van Breda Coll.

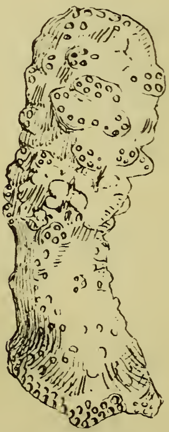

FIG. 18.—*Cyrtopora elegans*; × 8.
D. 3333.

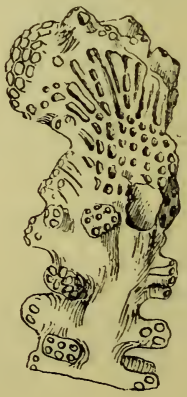

FIG. 19.—*Cyrtopora elegans*; × 8.
D. 3327.

Fig. 19, p. 54. The upper part of a zoarium, with highly raised prominences, and a gonœcium; × 8 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3327.**

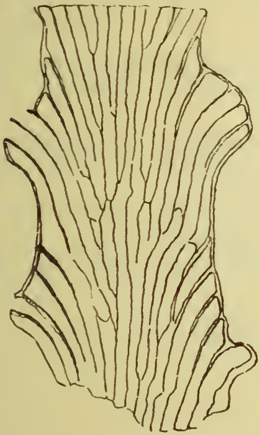

FIG. 20 = Vol. I. Fig. 30, p. 286.—*Cyrtopora elegans*; × 14. **D. 3326.**

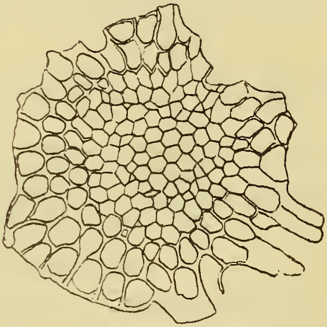

FIG. 21.—*Cyrtopora elegans*; × 18. **D. 3326.**

Fig. 20. Longitudinal section of part of a stem; × 14 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3326.**

Fig. 21. Transverse section of stem of the same specimen; × 18 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3326.**

AFFINITIES.

This species is the type of the genus. The stems are much thinner than in the Neocomian *C. campicheana*, d'Orbigny.

LIST OF SPECIMENS.

D. 3326. A small fragment in tube and three thin sections on slides cut from the same. Maastrichter Kalk. Maastricht. Van Breda Coll. Figs. 20, 21.

D. 3327. The end of a zoarium with especially thorny stem, owing to the height of the groups of apertures. Maastrichter Kalk. Maastricht. Van Breda Coll. Figd. p. 54, Fig. 19.

D. 3333. A young zoarium. Maastrichter Kalk. Maastricht. Van Breda Coll. Figd. p. 54, Fig. 18.

D. 3527. Four zoaria, one partly hollow. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3481. Ten zoaria, three of which show the base. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3323. Three specimens (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3322. Three specimens (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3402. Two specimens (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3324. Two specimens, one showing longitudinal section and the other transverse sections. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3325. Many zoaria. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 1345. Two specimens (on slide). Maastrichter Kalk. Maastricht. Vine Coll.

D. 3780. A fragment (on slide). Maastrichter Kalk. Valkenberg, near Maastricht. Gamble Coll. Identified by M. Pergens.

D. 6347. Five fragments (on slide). Maastrichter Kalk. Nedercanne. Busk Coll. Presented by Miss Busk.

UNREPRESENTED SPECIES.

campicheana, d'Orbigny, 1853.

Syn. *Cyrtopora campicheana*, d'Orbigny, 1853. Bry. Crét. p. 673, pl. 761, figs. 14, 15.
,, ,, Pergens, 1890. Rev. p. 377.

Char.—Zoarium of short, thick branches (6 mm. in dia.), growing in the same plane. Groups of apertures very large, with (*fide* d'Orbigny's figures) up to eighteen and twenty-four apertures in a group. Surface of zoarium marked by conspicuous longitudinal striæ.

Distrib.—Neocomian: Sainte-Croix, Vaud.

OSCULIPORA, d'Orbigny, 1849.

[Gen. nouv. Bry.: Rev. Mag. Zool. ser. 2, vol. i. p. 503.]

Synonyms.

Retepora, *pars*, Goldfuss, 1827; Milne-Edwards, 1838; von Hagenow, 1839, etc.
Idmonea, *pars*, de Blainville, 1834; von Hagenow, 1851, etc.
Truncatula, *pars*, von Hagenow, 1851; Vine, 1885; Pergens, 1888; Ulrich, 1900.
Cœlophyma, *pars*, von Hagenow, 1851.
Reptofascigera, *pars*, d'Orbigny, 1853.

Diagnosis.

Osculiporidæ in which the zoarium is fixed or free, but usually erect and branched. The ends of the zoœcia project in peristomal fascicles, which have their apertures in groups that all open on one aspect of the stem. The groups of apertures are circular or transversely elongate, and are placed alternately on the sides of the obverse face of the branches.

Reverse face smooth, or marked by linear interzoœcial depressions.
Gonœcia, ovoid bodies which usually project from the zoaria, and may appear as separate attached bodies.

TYPE SPECIES.

Retepora truncata, Goldfuss, 1827. Petref. Germ. vol. i. p. 29, pl. ix. fig. 14.

AFFINITIES.

There has been unfortunate confusion in the use of the name of this genus, as the *Retepora truncata* of Goldfuss has been used as the type of both *Osculipora* and *Truncatula*. That species has been generally regarded as a typical *Truncatula*, but it was selected by d'Orbigny in 1849 as the type of *Osculipora*, for it was the only species that he then mentioned as belonging to that genus. *Retepora truncata*, Goldf., must, therefore, be accepted as the type species of *Osculipora*. Von Hagenow, however, unfortunately overlooked *Osculipora*, and founded *Truncatula*[1] for the species *truncata* of Goldfuss and for two new species of his own, *T. filix* and *T. repens*. Another objection to *Truncatula* is that it is quoted by Scudder as having been preoccupied by Leach.

There can be no doubt that *Osculipora* must stand for the species *truncata*, and unless *Truncatula* be retained for one of the other species it cannot be retained for Bryozoa. In *Osculipora truncata* the zoœcia are grouped in round bundles, and the zoarium has a smooth or ribbed surface; whereas in von Hagenow's *Truncatula repens* the apertures not only open in linear series, but the reverse surface of the zoarium is perforated by abundant pores. The examination of young and well-preserved specimens of *T. repens* shows that its reverse surface is normally closed, and that the pores are only due to the wearing away of the walls of the zoœcia. The openings are of the same nature as in von Hagenow's figure of the reverse surface of his *Idmonea tetrasticha* (Bry. maastr. Kr. pl. iii. fig. 3*i*), which is only a very worn *O. truncata*.

The *Truncatula* of von Hagenow must, therefore, be merged in *Osculipora*. D'Orbigny has retained *Truncatula* for some species of Cytisidæ; he attributed the genus to von Hagenow, but only keeps in it one of that author's species, viz. *Idmonea filix*, which is a worn *O. truncata.*

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[1] Von Hagenow. Bry. maastr. Kr. 1851, pp. 34–6.

One species of *Truncatula* must be included among the Cancellata, as remarked on p. 109.

Osculipora differs from *Cyrtopora* by the fact that its groups of apertures do not open all round the stems, the reverse side having none.

The most difficult question with this genus is its separation from *Homœosolen*, which, however, has the apertures spread over the whole obverse face. When specimens show both obverse and reverse faces there is no difficulty, except when the surface of an *Osculipora* is so worn that the zoœcia are broken, and the openings thus made may resemble true apertures. The chief difficulty is with specimens of *Homœosolen* which are embedded in the matrix and show only the reverse face; the ends of the reflexed pinnules then resemble the fasciculi of *Osculipora.* Thus the species figured by von Hagenow as *Retepora striata*[1] shows only one face, and there is no absolute evidence as to whether it be an *Osculipora* or *Homœosolen*, though the identity of the characters that are shown with those of d'Orbigny's *Truncatula gracilis* renders it probable that the species is a *Homœosolen.*

1. **Osculipora truncata** (Goldfuss), 1827.

SYNONYMY.

Retepora	*truncata*,	Goldfuss, 1827. Petref. Germ. vol. i. p. 29, pl. ix. fig. 14.
,,	,,	Morren, 1829. Corall. foss. Belg.: Ann. Acc. Groning. 1828, p. 36.
,,	,,	Klöden, 1834. Verst. Brandenburg, p. 264.
,,	,,	Milne-Edwards, 1836. In Lamarck, Hist. nat. Anim. Vert. 2nd ed., vol. ii. p. 283.
,,	,,	Milne-Edwards, 1838. Mém. Crisies: Ann. Sci. nat. ser. 2, vol. ix. p. 219.
,,	,,	von Hagenow, 1839. Mon. Rüg.: Neu. Jahrb. 1839, p. 281.
,,	,,	von Hagenow, 1846. In Geinitz, Grundr. Verst. vol. ii. p. 591.
Idmonea	,,	de Blainville, 1830. Zooph.: Dict. Sci. Nat. vol. lx. p. 385.
,,	,,	de Blainville, 1834. Man. Act. p. 420.
Osculipora	,,	d'Orbigny, 1849. Gen. nouv. Bry.: Rev. Mag. Zool. ser. 2, vol. i. p. 503.
,,	,,	*pars*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 267.

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[1] Von Hagenow. In Geinitz, Grundr. Verst. vol. ii. (1846), p. 591, pl. xxiii B, fig. 3.

Osculipora truncata, d'Orbigny, 1853. Bry. Crét. p. 679.
,, ,, von Reuss, 1872–3. Bry. unt. Quad.: Palæontogr. vol. xx. pt. i. p. 122, pl. xxx. figs. 2, 3.
,, ,, von Reuss, 1874. Bry. ob. Plän.: *ibid.* vol. xx. pt. ii. p. 136.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 222.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 33.
,, ,, *pars*, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv. p. 37.
,, ,, *pars*, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 30.
Truncatula ,, von Hagenow, 1851. Bry. maastr. Kr. p. 35, pl. iii. fig. 2.
,, ,, Kade, 1852. Los. Verst. Schanzenb. p. 31.
,, ,, *pars*, Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 207.
,, ,, *pars*, Brauns, 1875. Sen. Salzbergs: Zeit. Ges. Naturw. vol. xlvi. p. 404.
,, ,, Vine, 1885. 5th Report: Rep. Brit. Assoc. 1884, p. 141.
,, ,, Pergens & Meunier, 1887. Bry. gar. Faxe: Ann. Soc. malac. Belg. vol. xxi., Mém. p. 222.
Idmonea pinnata, Giebel, 1848. Polyp. Plänerm.: Zeit. Zool. Zoot. vol. i. p. 11.
,, *tetrasticha*, von Hagenow, 1851. Bry. maastr. Kr. p. 34, pl. iii. fig. 3.
Cœlophyma lævis, *pars*, von Hagenow, 1851. *Ibid.* p. 105, pl. ii. fig. 15.
? ,, *constrictum*, von Hagenow, 1851. *Ibid.* p. 106, pl. ii. fig. 16.
Truncatula semicylindrica, *pars*, Boll, 1852. Geogr. Mekl.: Arch. Ver. Naturg. Meklenb. vol. vi. p. 63.

DIAGNOSIS.

Zoarium erect, simple or branching once or twice. The reverse face is well rounded and marked by longitudinal ribs. Peristomal fascicles highly raised and widely separated; they are subcircular at their free end, and each usually contains about a dozen apertures, but may contain twenty-four. The peristomal fascicles stand up either as mammilliform prominences or as well-developed cylindrical processes, which are often subalternate. The obverse face is smooth, and has a deep median groove between the peristomal fascicles.

Gonœcium ovoid, smooth, projecting conspicuously from the reverse side of the zoarium; sometimes crossed by a constriction.

DIMENSIONS.

	mm.
Length of zoarium	5
Diameter of branch	·6–1
Diameter of aperture	·07–·1
Diameter of peristomal fascicle	·3–·5
Length of peristomal fascicle	·3–1
Distance between centres of adjacent fascicles ...	·8
Diameter of gonœcium	1·2 × 1·3

DISTRIBUTION.

Senonian—Campanian: Jordberga, Balsberg, and Gropemöllan, Sweden.
Maastrichtian: Maastricht.
Coniacian: Salzberg, near Quedlinburg.
Turonian—Craie marneuse: Sainte-Rimay, Loir-et-Cher.

AFFINITIES.

Osculipora truncata (Goldf.) is the type of the genus, and is characterized by the cylindrical shape of the projecting zoœcial bundles; but when these are worn down, the specimens are not easily distinguished from *O. repens*.

According to von Hagenow, his *Cœlophyma constrictum* is attached to his *Idmonea tetrasticha*, in which case it should be the gonœcium of this species; his figure only shows the reverse side of the stem, and though it is possibly the reverse side of an *O. truncata*, the stem is straighter and more regular than usual in this species.

Marsson records the species from Rügen, but identifies it with the *Retepora striata* of von Hagenow, which appears, however, for reasons stated on pp. 58, 97, to be distinct, as it is probably the same as d'Orbigny's *Truncatula gracilis*.

LIST OF SPECIMENS.

D. 3390. About thirty zoaria (in tube), many of which have longer, flatter tufts than the specimen figured by von Hagenow. The reverse is marked by lines similar to those in *O. repens*, as shown in von Hagenow's illustration (Bry. maastr. Kr. pl. iii. fig. 1*h*). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 943. Three zoaria (on slide). Maastrichter Kalk. Maastricht. Purchased of Executors of G. R. Vine, October 28, 1893.

D. 1388. Four zoaria (on slide). Maastrichter Kalk. Maastricht. Purchased of Executors of G. R. Vine, October 28, 1893.

D. 3377. A zoarium (in tube). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3388. Two zoaria, one with well-marked lateral ridges on the peristomal fasciculi (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3389. Two zoaria, with worn fasciculi (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3392. Two zoaria (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3393. Two zoaria (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3536. A large zoarium, 11 mm. in length (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3764. Two zoaria (on slide). Maastrichter Kalk. Maastricht. Gamble Coll.

D. 4672. A specimen with about six zoœcia in each bundle, doubly branched. Craie marneuse. Sainte-Rimay. Purchased of F. H. Butler, December, 1898.

2. **Osculipora repens** (von Hagenow), 1851.

Synonymy.

Truncatula repens, von Hagenow, 1851. Bry. maastr. Kr. p. 36, pl. iii. fig. 1.
,, ,, Kade, 1852. Los. Verst. Schanzenb. p. 31.
,, ,, Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 207.
,, ,, Vine, 1885. 5th Report: Rep. Brit. Assoc. 1884, p. 141.
,, ,, Pergens, 1888. Tuf. Ciply: Bull. Soc. belge Géol. vol. i. p. 205.
non ,, ,, ? Vine, 1885. Camb. Greensd.: Proc. Yorks. Geol. Soc. new ser. vol. ix. p. 22.
non ,, ,, ? Vine, 1889. Further on Camb. Greensd.: *ibid.* vol. xi. p. 260.
non ,, ,, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 334.
Osculipora ,, d'Orbigny, 1853. Bry. Crét. p. 679.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 222.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 33.
,, ,, Ubaghs, 1888. C.R. Excursion: Bull. Soc. belge Géol. vol. i., Mém. p. 233.
? *Reptofascigera repens*, d'Orbigny, 1853. Bry. Crét. p. 679.
Cœlophyma lævis, pars, von Hagenow, 1851. Bry. maastr. Kr. p. 105.
Osculipora truncata, pars, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv. p. 37.

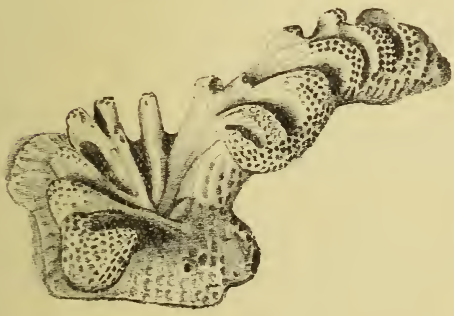

Fig. 22.—*Osculipora repens*; × 7.
D. 3373.

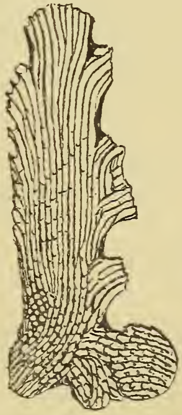

Fig. 23.—*Osculipora repens*; × 8.
D. 11,802.

DIAGNOSIS.

Zoarium of simple branches (which rarely subdivide), free distally, but proximally it may be adnate, and the base may be subcircular. The reverse face is rounded in the free portions, but elsewhere flat; it is marked by well-developed interzoœcial depressions.

Peristomal fascicles crowded and subalternate; each fascicle is transversely elongate, the series extending almost to the reverse side. Each bundle contains from ten to sixteen or even twenty apertures.

DIMENSIONS.

	Von Hagenow's type.	B.M. D. 1386.		B.M. D. 3373. Fig. 22, p. 61.
		Pl. VI. Fig. 2.	Pl. VI. Fig. 3.	
	mm.	mm.	mm.	mm.
Length of stem	6·5	10	10	6
Diameter of branch at base ...	1·2	1	1	1·5
Maximum	1·6	2·5	2·5	2
Diameter of aperture	—	·1	·1	·1
Diameter of peristomal fascicles	·6 × 1·6	1·5 × ·5	—	1·7 × ·3
Diameter of base	—	—	—	·5
Distance of peristomal fascicles (measured from centres of two adjoining fascicles on same side)	1	1	1	·6–1
Length of terminal fascicle ...	1·2	2	—	—

DISTRIBUTION.

Danian: Ciply (upper part of "tufeau de Ciply").
Senonian—Maastrichtian: Maastricht; Calcaire de Kunraed (Ubaghs).

FIGURES.

Pl. VI. Fig. 2. Figure of obverse face of a zoarium, complete except for the base; × 4 dia. Maastrichter Kalk: Maastricht. Vine Coll. **D. 1386.**

Pl. VI. Fig. 3. The basal part of another zoarium (on the same slide as specimen shown in Fig. 2); the figure shows the reverse and one side; × 4 dia. Maastrichter Kalk: Maastricht. Vine Coll. **D. 1386.**

Fig 22, p. 61. A zoarium with a wide, flat base and a short, thick stem, and unusually long, narrow series of apertures. There is a radial series of undeveloped branches opposite the developed branch; × 7 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3373.**

Fig. 23, p. 61. A thin longitudinal section along a stem with the cross-section of a lateral fascicle; × 8 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 11,802.**

AFFINITIES.

This species differs from *O. truncata* (Goldf.), as the zoarium is subadnate and rarely branched, and as the peristomal fascicles occur as transverse ridges and not as cylindrical processes.

LIST OF SPECIMENS.

D. 1386. Four zoaria (on slide). Maastrichter Kalk. Maastricht. Vine Coll. Two of the specimens are figured on Pl. VI. Figs. 2 and 3. Purchased of Executors of G. R. Vine, October 28, 1893.

D. 3373. A zoarium with flat base and one short, thick branch. Maastrichter Kalk. Maastricht. Van Breda Coll. Figd. p. 61, Fig. 22.

D. 3367. More than 100 specimens. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 11,802. Section on a slide cut from one specimen of the preceding lot. Figd. p. 61, Fig. 23.

D. 682. Two specimens (on slide). Maastrichter Kalk. Maastricht. G. R. Vine Coll.

D. 944. A worn specimen (on slide), labelled by Vine *Truncatula filix.* Maastrichter Kalk. Maastricht. G. R. Vine Coll.

D. 1387. A specimen (on slide). Maastrichter Kalk. Maastricht. Purchased of Executors of G. R. Vine, October 28, 1893.

D. 3368. A thick massive zoarium with base (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3376. Nine zoaria. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3391. A zoarium showing reverse face and immersed gonœcium. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3471. A zoarium with worn fasciculi (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3509. A zoarium (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3524. Two worn zoaria, one of which has several gonœcia. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3762. A worn zoarium (on slide). Maastrichter Kalk. Maastricht. Gamble Coll.

D. 5138. A zoarium with broad, discoid base (on slide), from one specimen. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 5139. Fourteen zoaria. Maastrichter Kalk. Maastricht. Van Breda Coll.

3. **Osculipora filix** (von Hagenow), 1851.

SYNONYMY.

Truncatula filix, von Hagenow, 1851. Bry. maastr. Kr. p. 35, pl. iii. fig. 4.
,, ,, d'Orbigny, 1854. Bry. Crét. p. 1053.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 226.
,, ,, Vine, 1885. 5th Report: Rep. Brit. Assoc. 1884, p. 141.
Osculipora ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 33.

DIAGNOSIS.

Zoarium simple; it consists of a stem rising from a laterally attached, expanded, adnate, sole-like base, which is on the obverse face of the colony. The branch is pinnate; the pinnules are opposite or subalternate, and are about equal in length to the width of the stem. A strong, smooth, cylindrical axis occurs along the middle of the obverse face.

Reverse face both of stem and pinnules is smooth.

Apertures occurring on the obverse face of the pinnules, and on the obverse face of the central stem, beside the midrib.

DIMENSIONS.

	Von Hagenow's type.	B.M. D. 3374.	
		Fig. 24, p. 65.	Fig. 25, p. 65.
	mm.	mm.	mm.
Length of zoarium	5·5	—	—
Diameter of branch across central axis	1–1·2	—	—
From tip to tip of opposite pinnules	2·5–4	—	—
Diameter of aperture	·1	—	·1–·12
Diameter of base	1·4 × 3·2	—	—
Distance between lateral fasciculi ...	1	—	—
Diameter of gonœcium	—	1·1 × 1·2	1 × 1·4

DISTRIBUTION.

Senonian—Maastrichtian: Maastricht.

FIGURES.

Fig. 24, p. 65. The end of a branch with an immersed gonœcium seen from the side; × 10 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3374.**

Fig. 25, p. 65. The end of a branch of another zoarium with gonœcium; × 10 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3374.**

AFFINITIES.

The attachment by a sole-like disc on the obverse face of the zoarium and the strong midrib are the most striking features of this species. The nearest ally of the typical form is *Osculipora pinnata*; for the regular form, with its thin, plate-like, peristomal ridges, is unlike the massive bundles of *O. repens*. Both *O. repens* and *O. filix* are very irregular, and it is impossible to draw any absolute line of division between these irregular forms.

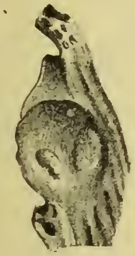

FIG. 24.—*Osculipora filix*; × 10. **D. 3374.**

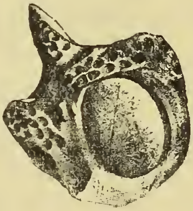

FIG. 25.—*Osculipora filix*; × 10. **D. 3374.**

LIST OF SPECIMENS.

D. 3374. Two branches of zoaria, with immersed gonœcia (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll. Figs. 24 and 25.

60,153. Four regular zoaria (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3369. Three irregular zoaria (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3370. A thick zoarium (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3372. The irregular base of a zoarium (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3375. Two zoaria, with regular but short peristomal ridges (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3381. Thirty-four zoaria. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3382. Three typical zoaria, with broad elliptical areas of attachment (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3383. Two regular zoaria (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3384. Two zoaria, with regular, pinnate, peristomal processes (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3385. One regular zoarium (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3386. Twelve specimens of the irregular variety. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3387. Twenty specimens of the irregular variety. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3516. A fragment of the irregular variety (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3605. One irregular zoarium (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3761. A specimen of the typical variety (on slide). Maastrichter Kalk. Maastricht. Gamble Coll.

D. 5140. Sixteen specimens of the irregular variety. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 6419. A specimen labelled *Idmonea disticha*, Goldf. ? Maastrichter Kalk. Maastricht. Busk Coll. Presented by Miss Busk.

UNREPRESENTED SPECIES.

1. **dentata** (von Hagenow), 1851. Name only.

Syn. *Truncatula dentata*, von Hagenow, 1851. Bry. maastr. Kr. p. 25.

Distrib.—Cretaceous: Sweden.

2. **gracilis** (von Hagenow), 1851. Name only.

Syn. *Truncatula gracilis*, von Hagenow, 1851. Bry. maastr. Kr. p. 25.

Distrib.—Senonian—Campanian: Rügen.

3. **houzeaui**, Pergens, 1894.

Syn. *Osculipora houzeaui*, Pergens, 1894. Nouv. Bry. Crét. Limb.: Bull. Soc. belge Géol. vol. vii., Mém. p. 174, pl. x. fig. 3 (*non* 4 as misprinted).

Char.—A very irregular zoarium, 2–6 mm. wide; erect or adnate. The apertures are in alternate or subalternate groups, which vary greatly in size and shape, and have from two to five rows in each.

Distrib.—Senonian—Maastrichtian: Fauquemont, near Maastricht.

Aff.—It differs from the other Maastrichtian species by the great irregularity of the zoarium and fasciculi.

4. **polystoma** (von Hagenow), 1851. Name only.

Syn. *Truncatula polystoma*, von Hagenow, 1851. Bry. maastr. Kr. p. 25.

Distrib.—Senonian—Campanian: Rügen.

5. **royana**, d'Orbigny, 1850.

Syn. *Osculipora royana*, d'Orbigny, 1850. Prod. Pal. ii. p. 268.
,, ,, d'Orbigny, 1853. Bry. Crét. p. 679, pl. 800 *bis*, figs. 1–4.
,, ,, Pergens, 1890. Rev. p. 377.

Char.—Zoarium retiform, horizontal; branches dichotomous and anastomosing, and keeping in the same plane. Branches nearly round; obverse face has very close groups of apertures, which are biserial; the apertures in each group very crowded. Reverse face smooth.

Distrib.—Senonian—Maastrichtian: Royan, Charente-Inférieure.

Remarks.—The plate 800 *bis* on which this species was figured is not given in any of the copies of d'Orbigny's work to which I have access, and there appear to be none in Paris.

MULTIFASCIGERA, d'Orbigny, 1853.

[Bry. Crét. p. 687.]

Synonym.

Meandrocavea, d'Orbigny, 1854.

Diagnosis.

Osculiporidæ with a massive zoarium which is either nodular or laminar; it is composed of numerous superposed sheets, between which are open spaces. Each sheet has the characters of the zoarium of *Lopholepis*.

Type Species.

M. campicheana, d'Orbigny, 1853. Neocomian: Switzerland.

Affinities.

This genus was founded on a Neocomian species, which may be regarded as a compound *Lopholepis*, composed of numerous superposed layers. M. Pergens included in the genus one of the two species of d'Orbigny's *Meandrocavea*, a suggestion which seems to me justified.

UNREPRESENTED SPECIES.

1. campicheana, d'Orbigny, 1853.

Syn. *Multifascigera campicheana*, d'Orbigny, 1853. Bry. Crét. p. 688, pl. 762, figs. 7–9.

,, ,, Canu, 1902. Bry. foss. i., Coll. Camp.: Bull. Soc. géol. France, ser. 4, vol. ii. p. 12.

Char.—Zoarium a somewhat egg-shaped mass, 60 mm. long by 35 mm. wide. Composed of numerous thick layers. Apertures in elliptical to sub-triangular groups, with about ten to twelve apertures in each cluster.

Distrib.—Neocomian: Sainte-Croix, Vaud.

2. elevata (d'Orbigny), 1854.

Syn. *Meandrocavea elevata*, d'Orbigny, 1854. Bry. Crét. p. 984, pl. 780, figs. 1–6.

Multifascigera (*Meandrocavea*) *elevata*, Pergens, 1890. Rev. p. 377.

Char.—Zoarium of a sheet thick in the middle and thin at the sides. Zoœcia arranged with their apertures opening on raised sinuous biserial or triserial ridges; the ridges are in places reduced in length into short tufts. Ridges separated by wide valleys.

Distrib.—Senonian—Coniacian: Vendôme, Loir-et-Cher.

3. **radiata** (d'Orbigny), 1854.

Syn. *Meandrocavea radiata*, d'Orbigny, 1854. Bry. Crét. p. 985, pl. 780, figs. 7–10.

Char.—Zoarium of a thick sheet. Zoœcia arranged with their apertures opening in short elliptical groups, which are well raised above the rest of the surface.

Distrib.—Senonian—Campanian: Meudon, near Paris.

HOMŒOSOLEN, Lonsdale, 1850.

[In Dixon, Geol. Sussex, p. 307.]

SYNONYMY.

Truncatula, *pars*, von Hagenow, 1851.
,, d'Orbigny, 1854; Vine, 1893.
Supercytis, d'Orbigny, 1854; *non* Macgillivray, 1895.
Unicytis, d'Orbigny, 1854; Gamble, 1896.

DIAGNOSIS.

Osculiporidæ with zoarium erect and flabellate; it is composed of cylindrical branches, usually in one plane. The branches are pinnate or dichotomous. The sub-branches may be reduced to mere lateral processes. The young zoaria (the *Supercytis* stage) are vase-shaped, having a flat base, narrow cylindrical stem, and cup-shaped head.

Apertures confined to the anterior surface, over the whole of which they are irregularly distributed.

Apertures appear crescentic in well-preserved specimens, as the zoœcia emerge obliquely. When the lower lip is worn away the aperture becomes elliptical.

TYPE SPECIES.

Homœosolen ramulosus, Lonsdale, 1850. In Dixon, Geol. Sussex, p. 307, pl. xviii b, figs. 3, 5 (*non* fig. 4). Chalk: Sussex.

AFFINITIES.

This genus was described in detail, and the structure illustrated in a series of excellent figures, by Lonsdale in 1850. His account was overlooked by von Hagenow and d'Orbigny, and the name has not been generally accepted.[1] It has, however, unquestionable claims to adoption, and the only doubt is how much is to be included within it. The genus clearly differs from the *Truncatula* of von Hagenow, which is an *Osculipora*, from which *Homœosolen* may be distinguished by having its apertures scattered over the whole obverse surface, whereas in *Osculipora* they are collected into raised groups. The *Truncatula* of d'Orbigny (1854) is not the same as the *Truncatula* of von Hagenow, and overlaps with *Homœosolen*.

The character of the zoœcia in *Homœosolen* has to be determined before its affinities are understood, and some of Lonsdale's figures suggest that the genus may be dimorphic. The sections shown in Figs. 27 and 28, cut from undoubted specimens of *Homœosolen*, show that the genus is monomorphic, and the zoœcia consist of long, simple tubes. When the zoœcia are cut across obliquely in longitudinal sections, such as Fig. 28 (p. 86), they sometimes appear tabulate; the apparent partitions, however, are only the walls of the zoœcia, which are lying oblique to the plane of the section.

The apertures in well-preserved zoœcia appear somewhat crescentic, owing to the projection of the lower edge of the aperture. In well-preserved specimens the apertures of the young zoœcia are scattered over the obverse face, and resemble small pores.

The zoœcia in young zoaria are arranged in bundles, showing the affinities of the genus to *Osculipora* (see e.g. Fig. 26, p. 79).

1. **Homœosolen pinnatus** (Römer), 1840.

SYNONYMY.

Idmonea pinnata,	Römer, 1840. Verst. nordd. Kr. p. 20, pl. v. fig. 22.
,, ,,	Michelin, 1846. Icon. Zooph. p. 203, pl. lii. fig. 9.
,, ,,	von Hagenow, 1846. In Geinitz, Grundr. Verst. vol. ii. p. 591.
non ,, ,,	Giebel, 1848. Polyp. Planerm.: Zeit. Zool. Zoot. vol. i. p. 11.
Crisisina ,,	d'Orbigny, 1850. Prod. Pal. vol. ii. p. 175.
Truncatula ,,	d'Orbigny, 1854. Bry. Crét. p. 1053.
,, ,,	Simonowitsch, 1871. Bry. Ess.: Verh. nat. Ver. preuss. Rheinl. vol. xxviii. p. 58, pl. iv. fig. 1.

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[1] Doubt on the date of the publication has been suggested by Morris, who, though assigning *Homœosolen* to 1849 in his text (Cat. Brit. Foss., 2nd ed., 1854, p. 125), recorded the date as 1852 in his list of references (p. v). Mr. Sherborn has shown (Geol. Mag. 1908, p. 287) that Dixon's work was issued in December, 1850.

? *Truncatula pinnata*, Vine, 1891. Rep. Cret. Polyz.: Rep. Brit. Assoc. 1890, p. 393.
? ,, ,, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 334.
Idmonea aculeata, Michelin, 1846. Icon. Zooph. p. 203, pl. lii. fig. 10.
Osculipora ,, *pars*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 177.
,, ,, d'Orbigny, 1850. Rev. Mag. Zool. i. p. 110.
Truncatula ,, d'Orbigny, 1854. Bry. Crét. p. 1054, pl. 796, figs. 1–5.
,, ,, von Reuss,[1] 1872–3. Bry. unt. Quad.: Palæont. vol. xx. pt. i. pp. 98, 122, pl. xxx. fig. 4.
,, ,, Pergens, 1890. Rev. p. 385.
? ,, ,, Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 507.
,, ,, Canu, 1897. Bry. St. Cal.: Bull. Soc. géol. France, ser. 3, vol. xxv. p. 748.
? ,, ,, Canu, 1900. Géol. Romorantin: *ibid.* vol. xxviii. p. 103.
non Homœosolen aculeatus, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 334.

DIAGNOSIS.

Zoarium large, irregular; arising from a broad base; usually three main branches, each of which may subdivide. The branches are wide and flat, giving off numerous long, wide sub-branches, which may be well reflexed or remain almost in the same plane as the axis of the branch.

Reverse surface smooth or transversely wrinkled.

Gonœcia are ovoid bodies on the reverse face.

DIMENSIONS.

	Römer's type.	Michelin.	D'Orbigny, pl. 796, figs. 1–5.	Simonowitsch.
	mm.	mm.	mm.	mm.
Zoarium: height	12	11	10	18
,, width	—	13	25	—
Branches: width of axis	1·5	1·6	4–5	2
,, width from tip to tip of lateral processes ...	3	—	12	6
Lateral processes: diameter... ...	·4	·5	1	·8 ?
,, ,, distance	1–1·5	1·8	2	1·5 ?
,, ,, length	1–1·8	·1	5	3 ?
Zoœcia: diameter of apertures ...	—	—	·2 ?	—

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[1] The specimen figured by von Reuss in the same work (pl. xxx. figs. 8*a*, *b*) as *Desmepora semicylindrica* appears to be probably a worn specimen of this species, but without knowledge of the obverse surface no satisfactory decision is possible. The zoarium has strikingly the aspect of an *Homœosolen pinnatus*.

DISTRIBUTION.

BRITISH:

Cenomanian—Zone of *Pecten asper* and zone of *Schloenbachia rostrata*: Haldon Hills, Devon.

FOREIGN:[1]

Cenomanian: Essen, Germany; Le Mans.
Lower Pläner: Plauen.

AFFINITIES.

This species has been confused with its ally *Homœosolen tetragonus* (Mich.), which is here, however, accepted as distinct. *H. tetragonus* differs by having thinner stems and more regularly reflexed branchlets; the latter character is the less reliable, but the difference between the long, regular, dichotomous stems of *H. tetragonus* and the wide, flat, irregular branches of *H. pinnatus* seems to be of specific value. The sub-branches are often reduced to mere lateral processes. Simonowitsch has suggested that the difference between *H. tetragonus* and *H. pinnatus* may be only varietal. The *Idmonea aculeata* of Michelin seems to me clearly the same species as *H. pinnatus*, a conclusion adopted by von Hagenow in 1846.

The section figured by Simonowitsch in 1871[2] shows that the zoœcia are monomorphic.

D'Orbigny has adopted the view that Michelin's *I. pinnata* is a distinct species from that of Römer, but as he lays stress on the great width of Römer's species it seems to me that Michelin was correct in his determination.

LIST OF SPECIMENS.

BRITISH.

D. 7446. A zoarium in chert. Cenomanian—zone of *Pecten asper*. Haldon Hills, south-west of Exeter. W. Vicary Coll. Bequeathed 1903.

D. 7443. A large branched zoarium. Cenomanian—zone of *Pecten asper*. Haldon Hills, south-west of Exeter. W. Vicary Coll. Bequeathed 1903.

D. 7445. A zoarium in chert. Cenomanian—zone of *Pecten asper*. Haldon Hills, south-west of Exeter. W. Vicary Coll. Bequeathed 1903.

D. 7444. A zoarium in chert. Cenomanian—zone of *Pecten asper*. Haldon Hills, south-west of Exeter. W. Vicary Coll. Bequeathed 1903.

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[1] The species has been recorded from the French Senonian.

[2] Simonowitsch. Bry. Ess.: Verh. nat. Ver. preuss. Rheinl. vol. xxviii. pl. iv. fig. 1*f*.

D. 7377. The base of a zoarium. Albian—zone of *Schloenbachia rostrata* Haldon Hills, south-west of Exeter. W. Vicary Coll. Bequeathed 1903.

D. 7378. The base of a zoarium. Albian—zone of *Schloenbachia rostrata.* Haldon Hills, south-west of Exeter. W. Vicary Coll. Bequeathed 1903.

FOREIGN.

D. 3610. Five irregular branches, of which one is 10 mm. long and 3 mm. wide; the pinnules are flat, and the form approaches to *O. repens.* Cenomanian—Essener Grünsand. Essen. Old Coll.

D. 3611. Two zoaria, one broken to show both obverse and reverse faces. Essener Grünsand. Essen. Old Coll.

D. 3612. A very worn zoarium in which the reverse side accordingly appears porous, and the apertures appear, owing to the worn condition, to be spread over the whole obverse face. Essener Grünsand. Essen. Old Coll.

D. 3693. Six fragments of zoaria, one of which shows the gonœcium. Cenomanian. Le Mans. Tesson Coll.

D. 3708. A worn basal fragment. Cenomanian. Le Mans. Tesson Coll.

D. 3691. A zoarium encrusted by Cheilostomata. Cenomanian. Le Mans. Tesson Coll.

2. **Homœosolen tetragonus** (Michelin), 1846.

SYNONYMY.

	Idmonea	*tetragona*,	Michelin, 1846. Icon. Zooph. p. 219, pl. liii. fig. 19.
	Truncatula	,,	d'Orbigny, 1854. Bry. Crét. p. 1056, pl. 796, figs. 10–14.
	,,	,,	Pergens, 1890. Rev. p. 385.
non	,,	,,	Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 334.
	,,	,,	Canu, 1897. Bry. St. Cal.: Bull. Soc. géol. France, ser. 3, vol. xxv. p. 748.
?	,,	,,	Canu, 1900. Géol. Romorantin: *ibid.* vol. xxviii. p. 104.
	,,	,,	Canu, 1903. Faune Cr. Villedieu: *ibid.* ser. 4, vol. iii. p. 268.
	,,	*subpinnata*,	d'Orbigny, 1854. Bry. Crét. p. 1055, pl. 796, figs. 6–9.
	,,	,,	Pergens, 1890. Rev. p. 385.
non	,,	,,	Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 334.
	Osculipora	*aculeata*, *pars*,	d'Orbigny, 1850. Prod. Pal. vol. ii. p. 177.
	,,	*lateralis*,	d'Orbigny, 1850. *Ibid.* p. 177.

DIAGNOSIS.

Zoarium of long, slender stems, which dichotomize occasionally. The stems are slightly flattened, and bear numerous short, simple, lateral processes, which are sharply reflexed from the plane of the stem. Reverse face of the zoarium with long, raised ridges, which are continued along the lateral processes; the longitudinal ridges may be replaced in the lower parts of older branches by curved transverse ridges.

Dimensions.

	Michelin's figure of the type.	D'Orbigny.
Length of branch	15 mm. ...	14 mm.
Width of the axis	1 ,, ..	1 ,,
Width from tip to tip of lateral processes about	1·2 ,, ...	1·5 ,,
Diameter of lateral processes	·5 ,, ...	·3 ,,
Distance of lateral processes	·8 ,, ...	·5 ,,

Distribution.

Cenomanian:[1] Le Mans; St. Calais, Sarthe.

Affinities.

This species is characterized by its long, slender branches; the lateral processes are more regular and more sharply reflexed than in its nearest ally, *H. pinnatus* (Röm.).

D. 3692. Four zoaria. Cenomanian. Le Mans. Tesson Coll.

3. **Homœosolen carinatus** (von Reuss), 1846.

Synonymy.

Hornera carinata,	von Reuss, 1846. Verst. böhm. Kr. p. 63, pl. xiv. fig. 6.
,, ,,	Vine, 1885. Fifth Report: Rep. Brit. Assoc. 1884, p. 147.
non Crisisina carinata,	d'Orbigny, 1850. Prod. Pal. vol. ii. p. 265.
non Truncatula ,,	d'Orbigny, 1854. Bry. Crét. p. 1058, pl. 797, figs. 5–15.
non ,, ,,	Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 512.
non Homœosolen carinatus,	Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 334.
Osculipora plebeia,	Novak, 1877. Bry. böhm. Kreidef.: Denk. Akad. Wiss. Wien, vol. xxxvii. pt. ii. p. 112, pl. x. figs. 16–34.
,, ,,	Frič, 1883. Isersch.: Arch. naturw. Landesf. Böhm. vol. v. No. 2, p. 127.
? ,, ,,	Vine, 1885. Camb. Greensd.: Proc. Yorks. Geol. Soc. new ser. vol. ix. p. 22.
? ,, ,,	Vine, 1889. Further on Camb. Greensd.: *ibid.* vol. xi. p. 270.
,, ,,	Počta, 1892. Mech. Koryc. Vrstev: Ceska Akad. Cis. Fr. Jos. vol. ii. p. 7, fig. 3; pp. 26–33.
non Semicytis ,,	Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 333.

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[1] This species is recorded by Canu from the Senonian (Santonian) of Romorantin and Phelippeaux.

Diagnosis.

Zoarium with thick, well-rounded branches, rising from a broad, flat base; the branches divide irregularly and are usually alternate; each branch bears numerous lateral processes, which are usually opposite or nearly opposite.

The reverse surface in well-preserved parts of the zoarium is tumid and ribbed, and, when worn, numerous openings are produced by the wearing away of the hinder walls of the zoœcia.

There are from six to twenty zoœcia in each lateral process; the groups are circular or may be flattened, and are then biserial or triserial.

Gonœcium on reverse surface; ovoid, but with pointed ends.

Dimensions.

	Von Reuss' type.	Novak.	Cambridge Greensand.	
			B.M. D. 1872.	B.M. D. 1880.
	mm.	mm.	mm.	mm.
Zoarium: height	3·5	5–20	3·5	3–6
,, diameter of branch	·6	1–3	·4–·6	·5–1
,, diameter of base ...	—	12	1·6	4
Zoœcia: diameter of aperture	—	—	·1[1]	·1–·15
,, distance between centres of adjacent apertures... ...	—	—	·2–·4	·3–·5

Distribution.

British:

Cambridge Greensand: Cambridge.

Foreign:

Cenomanian—Korycaner Schichten: Kamajk, Kank, Jiné, etc., Bohemia
Ostrea carinata beds, Kahlebusch, near Dohna, Saxony.
Lower Pläner: Schillinge, near Bilin, and Weisskirchlitz, Bohemia.

Figures.

Pl. VI. Fig. 4. Base of a young zoarium, Vine's *Osculipora plebeia*. Cambridge Greensand. Jesson Coll. Fig. 4*a*, the obverse face; × 10 dia. Fig. 4*b*, the reverse face of the same specimen; × 10 dia. Fig. 4*c*, the end of the stem from above, showing the triangular form of the branch; × 15 dia. **D. 1872.**

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[1] The elliptical apertures of worn zoœcia may be ·2 mm. long.

Pl. VI. Fig. 5. The worn base of a five-branched zoarium, also Vine's *Osculipora plebeia*. Cambridge Greensand. Jesson Coll. Fig. 5*a*, the obverse face of the zoarium; × 6 dia. Fig. 5*b*, the reverse face of the same specimen; × 6 dia. **D. 1880.**

AFFINITIES.

This species is best known from the fine series of figures given by Novak, who described it as a new species and made no reference to the *Hornera carinata* of von Reuss. The two names, however, appear to be synonymous, for though the original figure of *carinata* is sketchy it represents the tumid, well-rounded, and striated stems which are so conspicuous in *O. plebeia*.

The Senonian Bryozoon, identified by d'Orbigny as *T. carinata*, appears to me, however, essentially distinct, and to include forms of the two species *H. ramulosus* and *H. gamblei*.

Počta (*op. cit.* p. 7, fig. 3) gives an excellent transverse section (× 26 dia.) showing the intimate structure of the species; the large zoœcia in the lateral processes are ·1 mm. in dia., while the longitudinal zoœcia in the stem are smaller, ranging from ·08 down to ·02 mm. in dia. The stem is strengthened front and back by a layer of laminated tissue, which does not appear to have any cancelli. The structure is essentially that of the Cyclostomata Tubulata, and not of the Cancellata.

LIST OF SPECIMENS.

BRITISH.

D. 1872. Two fragments; one is the worn base of a young zoarium (on slide). Cambridge Greensand. Cambridge. Jesson Coll. Recorded as *Osculipora plebeia*, Novak, by Vine, 1885. Proc. Yorks. Geol. Soc. new ser. vol. ix. p. 22; and 1889, *ibid.* vol. xi. p. 270. Figd. Pl. VI. Figs. 4*a–c*.

D. 1880. Four fragments (on slide); one is the base of a five-branched zoarium. Cambridge Greensand. Cambridge. Jesson Coll. Recorded as *Osculipora plebeia*, Novak, by Vine, 1885. Proc. Yorks. Geol. Soc. new ser. vol. ix. p. 22; and 1889, *ibid.* vol. xi. p. 270. Figd. Pl. VI. Figs. 5*a*, *b*.

D. 1877. Three fragments of the bases of zoaria (on slide). Cambridge Greensand. Cambridge. Jesson Coll.

FOREIGN.

D. 4435. Four specimens. Cenomanian—Korycaner Schichten. Kamajk, Bohemia. Purchased of Dr. Anton Frič.

D. 11,799. Two fragments of zoaria (on slide). Cenomanian—Korycaner Schichten. Kamajk, Bohemia. Purchased of Dr. Anton Frič.

D. 4464. A tube with twelve fragments. Cenomanian—*Ostrea carinata* beds. Kahlebusch, near Dohna, Saxony. Presented by Dr. H. Credner, June 7, 1898.

4. Homœosolen tenuis (Novak), 1877.

SYNONYMY.

Truncatula tenuis, Novak, 1877. Bry. böhm. Kr.: Denk. Akad. Wiss. Wien, vol. xxxvii. pt. ii. p. 113, pl. x. figs. 9–15.

,, ,, Frič, 1883. Isersch.: Arch. naturw. Landesf. Böhm. vol. v. No. 2, p. 127, fig. 109.

DIAGNOSIS.

Zoarium of slender branches, which divide dichotomously and bear short lateral processes, which are distant and either opposite or alternate, and remain in the same plane as the stem.

Obverse surface regularly rounded.

Reverse surface with numerous longitudinal, fine, raised lines, between which are lines of pores, or it may be covered by a nonporous layer, which is transversely wrinkled.

DISTRIBUTION.

Lower Senonian—Iserschichten: Gross Ujezd, Vetelno, Bohemia.

AFFINITIES.

This species is a near ally of *H. striatus* (Hag.), the *Truncatula gracilis*, d'Orb. (p. 97), from which it differs most definitely by the wide separation of the lateral processes in *H. tenuis*, whereas in *H. striatus* they are so close together that they overlap.

D. 4434. One zoarium. Senonian—Iserschichten. Vetelno, Bohemia. Purchased of Dr. Anton Frič.

5. Homœosolen ramulosus, Lonsdale, 1850.

SYNONYMY.

? *Retepora costata*, von Hagenow, 1840. Mon. Rüg. ii.: Neu. Jahrb. 1840, p. 646.

? *Truncatula* ,, von Hagenow, 1851. Bry. maastr. Kr. p. 25.

? *Retepora flexuosa*, Mantell, 1844. Med. Creation, vol. i. p. 285, fig. 11.

? *Millepora dichotoma*, Mantell, 1844. *Ibid.* pp. 284, 287, and fig. 9, p. 285.

Homœosolen ramulosus, *pars*, Lonsdale, 1850. In Dixon, Geol. Sussex, p. 307, pl. xviii B, figs. 3–5.

Homœosolen ramulosus, Mantell, 1854. Med. Creation, 2nd ed., p. 271, figs. 9, 11.
,, ,, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, pp. 333–4.
,, *aculeatus*, Vine, 1893. *Ibid.* p. 334.
Crisisina carinata (*non* Reuss), d'Orbigny, 1850. Prod. Pal. vol. ii. p. 265.
Truncatula ,, (*non* Reuss), *pars*, d'Orbigny, 1854. Bry. Crét. p. 1058, pl. 797, figs. 5–10, *non* 11–15.
,, ,, (*non* Reuss), Peron, 1888. Craie Anglo-Par.: Bull. Soc. Sci. nat. Yonne, vol. xli. p. 264.
non ,, ,, Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 512.
,, ,, Canu, 1900. Bry. Tours: C.R. Assoc. franç. Av. Sci. 1899, p. 410.
,, ,, Canu, 1903. Faune Cr. Villedieu: Bull. Soc. géol. France, ser. 4, vol. iii. p. 266.
Homœosolen ,, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1893, p. 334.
? *Supercytis digitata*, d'Orbigny, 1854. Bry. Crét. p. 1060, pl. 798, figs. 6–9.
,, ,, Pergens & Meunier, 1887. Bry. gar. Faxe: Ann. Soc. malac. Belg. vol. xxi., Mém. p. 221.
non ,, ,, Reuss, 1872–3. Bry. unt. Quad.: Palæontogr. vol. xx. pt. i. p. 123, pl. xxx. fig. 5.
non ,, ,, Reuss, 1874. Bry. ob. Plän.: Palæontogr. vol. xx. pt. ii. p. 136.
,, ,, Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 512.
non ,, ,, ? Macgillivray, 1895. Mon. Polyz. Vict.: Trans. R. Soc. Vict. vol. iv. p. 145, pl. xxii. figs. 1, 2.
,, ,, Gamble, 1896. Cat. Bry. Chatham, p. 6.
Homœosolen alternatus, d'Orb., Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 334.
? *Semicytis plebeia*, Vine, 1893. *Ibid.* p. 333.

DIAGNOSIS.

Zoarium of broad, thick branches which increase in number either by dichotomous division or by giving off secondary branches, which bend forward and run in the same direction as the branch from which they have sprung. The even curves of the branches give the zoarium a somewhat flamboyant aspect. The sub-branches taper regularly. The shorter sub-branches appear, owing to their quickly tapering and curved form, as hook-shaped processes from the stems.

Both surfaces of the main stems may be flat or of an even curve, but may be sub-carinate in places.

The apertures of young zoœcia appear like pores in well-preserved specimens.

DIMENSIONS.

	Lonsdale's type. pl. xviii B, fig. 3. D. 2945.	Mid. Chalk: Chatham. B.M. D. 407. Pl. III. Fig. 7.	Upper Chalk: Beachy Head. B.M. D. 7105.
	mm.	mm.	mm.
Zoarium: length of branch ...	40	—	—
,, diameter of branch ...	up to 2	1·1	2
,, length of sub-branch ...	2–15	1·7	—
,, diameter of sub-branch	up to 1·2	·7	—
,, distance of sub-branches	2 up to 20 without a sub-branch	—	—
Zoœcia: diameter of aperture ...	·08–·1	·06–·08	·1
,, distance of centres of adjacent apertures ...	up to ·2	·1–·15	·2
Gonœcia	—	1 × 1·3	—

DISTRIBUTION.

BRITISH:

Upper Chalk—Zone of *Micraster coranguinum*: Bromley, Kent; Charlton, Kent; Gravesend.

Middle Chalk—Zone of *M. cortestudinarium*: Chatham.

Lower Chalk—Zone of *M. breviporus*: Dover.

Chalk: Sussex; Beachy Head; Charing, Kent; Dover; Maidstone; Offham's Pit, Lewes; St. Catherine's Hill, Guildford; Stocker's Head, near Charing, Kent.

FOREIGN:[1]

Senonian—Maastrichtian: Sainte-Colombe, Manche.

Campanian: Rügen; Meudon, near Paris.

Coniacian: Lisle, Loir-et-Cher; Tours; Fécamp, Seine-Inférieure; Phelippeaux, Charente-Inférieure.

Turonian—Angoumian: Lavardin, Loir-et-Cher; La Collinière (zone of *Micraster breviporus*).

FIGURES.

Pl. III. Fig. 7. Part of a branch, showing the whole of a pinnule and a gonœcium; × 10 dia. Chalk—zone of *Micraster cortestudinarium*: Chatham. Gamble Coll. **D. 407.**

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[1] D'Orbigny gives a list of French localities, but there is nothing to indicate which of them yielded the typical *ramulosus* and which the pinnate form *H. gamblei.*

Fig. 26. The obverse and reverse sides of a young zoarium; × $10\frac{1}{4}$ dia. Chalk: Charing, Kent. T. R. Jones Coll. **D. 2831.**

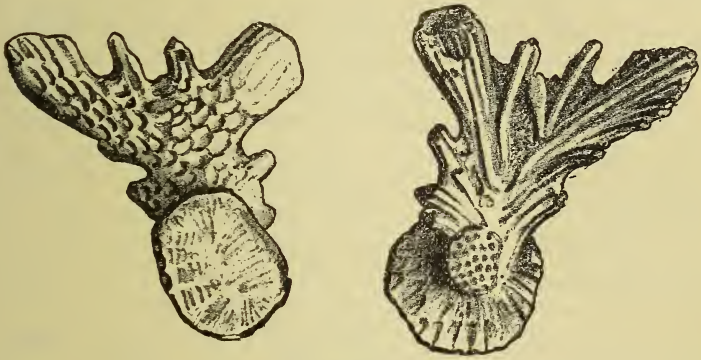

FIG. 26.—*Homœosolen ramulosus*; × $10\frac{1}{4}$. **D. 2831.**

Fig. 27. Thin longitudinal section through the end of a branch, showing the simple tubulate form of the zoœcia; × 9 dia. Upper Chalk: Beachy Head. Presented by J. W. Gregory. **D. 7105.**

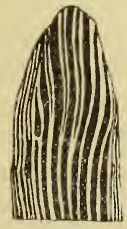

FIG. 27.—*Homœosolen ramulosus*; × 9. **D. 7105.**

Pl. IV. Fig. 2. A worn zoarium on which has grown a young lamellibranch. Fig. 2*a*, the specimen, × 2 dia.; Fig. 2*b*, part of main branch, × 10 dia. Upper Chalk. Loc.? (probably south-east of England). Old Coll. **D. 4576.**

AFFINITIES.

This species is unquestionably the type of the genus *Homœosolen*. The specific name is open to question, as Mantell's *Retepora flexuosa* is six years older than *H. ramulosus*; and Mantell's simple figure represents a specimen with the alciform, tapering branches of *H. ramulosus*. Nevertheless, as Mantell's figure was so small and crude and his reference to it inadequate, Lonsdale's elaborately figured species may be allowed to stand. For Mantell's figure is open to the doubt that it does not show the generic characters, and can only be recognized by accessory features. Mantell's *Millepora dichotoma* appears to be a terminal fragment of the same species.

Von Hagenow's *Retepora costata* is another name that has claims to consideration for this species. It was given in 1840 to a Bryozoon from Rügen that was briefly described but not figured. The description indicates that it is a *Homœosolen*, with compressed, thick stems, with a smooth obverse face crowded with pores, and a longitudinally ribbed reverse surface. The branchlets are described, however, as irregular and reflexed, whereby it differs from *H. ramulosus*, in which they lie in the same plane as the stem from which they come. The Laur Collection in the Museum includes a few fragments of a *Homœosolen*, which, though they do not show the reflexed branchlets, probably belong to von Hagenow's *R. costata*. Owing to this uncertainty Lonsdale's name may well be retained, as with the evidence available in 1850 he would not have been justified in identifying his species with the *R. costata* of von Hagenow.

LIST OF SPECIMENS.

D. 2945. The type-specimen and part of the same isolated to show both surfaces. Upper Chalk. Gravesend. Bowerbank Coll. Figd. Lonsdale in Dixon, Geol. Sussex, pl. xviii B, fig. 3. The branches are 1½ mm. wide; obverse tumid, back flat; branches may extend for 15 mm., with branchlets on one side of the stem only.

D. 2950. A paratype. The specimen figured by Lonsdale, *op. cit.* pl. xviii B, fig. 5. The specimen shows only the reverse face; the largest branches are 18 mm. long; most of the branches are long and wavy in course; a few have no sub-branches, but most of them three or five sub-branches in a length of 5 mm. The diameter of the branches is ·5 mm. Chalk. Sussex. Dixon Coll.

B. 4492. Paratype. This section shows that the small pores appear to be young zoœcia, as they pass up gradually to mature zoœcia. Upper Chalk. Loc.? Figd. by Lonsdale in Dixon, Geol. Sussex, pl. xviii B, fig. 4*b*. Dixon Coll.

B. 4493. Paratype. A fragment showing lateral sections. Upper Chalk. Loc.? Figd. by Lonsdale in Dixon, Geol. Sussex, pl. xviii B, figs. 4*c*, *d*. Dixon Coll.

D. 407. Three specimens (on slide). One is a well-preserved zoarium with short, bent, hook-like branchlets; a large gonœcium on the obverse surface. Middle Chalk — zone of *Micraster cortestudinarium*. Chatham. Gamble Coll. Figd. Pl. III. Fig. 7.

D. 2831. A young zoarium, of which the species is not certain, but is probably *H. ramulosus.* Chalk detritus. Charing, Kent. Professor T. R. Jones Coll. Fig. 26, p. 79.

D. 7105. A small branch with longitudinal and transverse sections cut from it. Upper Chalk. Beachy Head. Presented by Dr. J. W. Gregory. Longitudinal section, Fig. 27, p. 79.

D. 4576. A zoarium on which has grown a young lamellibranch. Upper Chalk. Loc. ? (probably south-east of England). Old Coll. Figd. Pl. IV. Figs. 2*a*, *b*.

5439. A young *ramulosus* with six radial branches and short alternate sub-branches. The specimen shows the whole obverse celluliferous surface; the longest branch is 13 mm. from the centre. The branches radiate horizontally from a short stem, 1 mm. in dia. and slightly over 1 mm. high. The average diameter of the main branches is 1 mm.; of the branchlets about ·4 mm. Chalk. South-east of England. Mantell Coll.

60,251. A large, irregular, loosely branched frond; it is 52 mm. high; most of it shows the obverse surface, but some of it the reverse, which is carinate. Chalk. Loc. ? Dixon Coll.

60,341. A broken zoarium and a longitudinal section cut from it; the reverse side has a blunt ridge. Upper Chalk. Sussex. Dixon Coll.

B. 69. Three young zoaria. Chalk. Sussex. J. S. Gardner Coll.

B. 103. Two large branched stems showing obverse and reverse surfaces; one is 18 mm. high and 15 mm. wide. The small pores are seen on the well-preserved parts of the zoarium. The reverse surface is strongly carinate. Chalk. Stocker's Head, north-east of Charing, Kent. Professor T. R. Jones Coll.

D. 394. Two very small zoaria of form *Supercytis digitata* (on slide). Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

D. 403. Three branches showing obverse and reverse faces (on slide). Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

D. 404. Three older zoaria of form *Supercytis digitata*, one with broad basal attachment (on slide). One specimen has typical *ramulosus* branching and thick branches. Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

D. 406. Three fragments with hooked branches (on slide). Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

D. 462. A branch 30 mm. long partly encrusted by *Membranipora.* Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

D. 498. Fragment of a young specimen presenting the obverse surface. Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

D. 667. Two fragments with very sharply pointed, rapidly tapering sub-branches, showing obverse and reverse faces (on slide). Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Vine Coll., No. 73. Recorded as *Homœosolen* (*Truncatula*) *aculeata.*

D. 669. Four branches showing obverse and reverse faces (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll., No. 73 *a*.

D. 670. Two fragments showing obverse and reverse (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll., No. 73.

D. 671. Two branches showing obverse and reverse faces (on slide). Middle Chalk — zone of *Micraster cortestudinarium*. Chatham. Vine Coll., No. 72.

D. 678. Two long, thin, terminal branches with distant and alternate sub-branches (on slide). One is 8 mm. long and has the bases of two sub-branches on each side. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll., No. 77. Recorded as *Truncatula alternata*.

D. 679. A fragment with short, sharp sub-branches (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Vine Coll., No. 76. Recorded as *Truncatula aculeata*.

D. 2666. Two fragments (on slide); one shows the obverse and the other the reverse surfaces. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll., No. 52. Purchased 1898.

D. 2748. A young asymmetrical base and a fragment with the typical branching (on slide), with a specimen of *H. gamblei*. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll.

D. 2750. A cup-shaped base in the form of *Supercytis digitata*; it has the broken bases of nine branches on its rim (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll.

D. 3052. A large zoarium and a fragment of another. The zoaria have flamboyant branching. They show mainly the reverse surface, but part of the obverse surface of one has been exposed. The basal stem is 3 mm. in dia.; the frond of the same specimen is 36 mm. wide and 25 mm. high. Chalk. Loc.? Old Coll.

D. 3053. A young zoarium with a broad base, on flint, with *Nodelea durobrivensis*, Greg., and *Onychocella* sp. Middle Chalk — zone of *Micraster cortestudinarium*. Chatham. Presented by William Gamble, Esq., 1889.

?D. 3054. Base and part of a young zoarium, mostly embedded in flint. Middle Chalk — zone of *Micraster cortestudinarium*. Near Chatham. Presented by W. Gamble, Esq., January, 1889. (With *Membranipora*.)

?D. 3055. A branch partly embedded in flint. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Presented by William Gamble, Esq., January, 1889.

D. 3115. Fragments of three zoaria; one is 15 mm. high and has crowded branches. Upper Chalk. Gravesend. Old Coll.

?D. 3950. Two zoaria embedded in flint; they show the bases and the proximal ends of the branches. The specimens are too fragmentary for certain specific determination, but their agreement with **D. 4366** renders it probable that they are *H. ramulosus*. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

D. 3952. Five zoaria and fragments; one is 11 mm. long and 1·5 mm. thick. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll. Purchased 1898.

D. 3964. Three loose isolated branches. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Labelled *Truncatula carinata*. Gamble Coll.

D. 4097. The base of a young *Homœosolen*, probably *H. ramulosus*. The fragment is 5 mm. high and rises from a stolon-like base of which 4 mm. remain. The bases of the branches form a funnel-shaped zoarium. Both surfaces are exposed. Middle Chalk — zone of *Micraster cortestudinarium*. Chatham. Gamble Coll. Purchased 1898.

D. 4349. Three fragments of zoaria. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

D. 4366. A young zoarium in the *Supercytis digitata* stage; the base is a horizontal stem of which 2·5 mm. is left; the height of the specimen is 5 mm. and the greatest width 7 mm. Middle Chalk —zone of *Micraster cortestudinarium*. Chatham. Gamble Coll. The specimen is labelled *Supercytis digitata*, Gamble.

D. 4379. A large, well-preserved zoarium; the fine apertures of the young zoœcia are abundant in the lower branches, but scarce in the distal ends of the branches. Lower Chalk — zone of *Micraster breviporus*. Dover. Presented by William Hill, Esq., F.G.S., December 15, 1897.

D. 4382. A small zoarium. Lower Chalk — zone of *Micraster breviporus*. Dover. Presented by William Hill, Esq., F.G.S., December 15, 1897.

D. 4383. Part of a larger zoarium, showing the reverse surface. Lower Chalk —zone of *Micraster breviporus*. Dover. Presented by William Hill, Esq., F.G.S., December 15, 1897.

D. 4402. A young frond having thick basal branches, showing the base and obverse surface; frond 11 mm. by 9 mm.; branches 1·5 mm. thick. Chalk. Loc.? Old Coll.

D. 4407. Fragment of a frond about 20 mm. square; it exposes the reverse surface, which is strongly ridged; a small part of the obverse surface has been exposed. Chalk. Offham's Pit, Lewes. Caprôn Coll.

D. 4404. The typical form of *H. ramulosus*, with elliptical apertures and pores in the middle of the branches. Upper Chalk. Bromley, Kent. Toulmin Smith Coll.

D. 4405. A young broken zoarium, showing the flamboyant branching. Chalk. St. Catherine's Hill Pit, near Guildford. H. Capron Coll.

D. 4408. An irregular zoarium, with the typical *ramulosus* branching of the crowded variety, showing obverse surface. Upper Chalk—zone of *Micraster coranguinum*. Charlton, Kent. J. Simmons Coll. 1870.

D. 4410. Fragment from Chalk. Dover. Old Coll.

D. 4414. An irregular zoarium. Chalk. Dover. Bowerbank Coll.

D. 4480. Two zoaria of the typical *H. ramulosus* on a slab of chalk. Chalk. Near Maidstone. Bowerbank Coll.

D. 4482. A large irregular zoarium showing reverse surface, with an isolated fragment which shows the obverse surface. Chalk. Loc. ? Old Coll.

D. 4506. The base of an asymmetrical young zoarium (*Supercytis digitata* form) (on slide). The branches are long and thin. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

D. 4507. The base of a rather tall variety with pronounced growth in one direction. The *Supercytis digitata* stage (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

D. 4575. A branch showing obverse face. Chalk. Dover. Bowerbank Coll.

FOREIGN.

D. 10,987. Four fragments of branches (in tube). Senonian — Campanian. Rügen. Purchased of Frau Agnes Laur, October, 1906.

D. 10,988. Three fragments of the same (in tube). Senonian — Campanian. Rügen. Purchased of Frau Agnes Laur, October, 1896.

6. **Homœosolen gamblei,** Gregory, 1909.

SYNONYMY.

Homœosolen gamblei, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 62.
,, *ramulosus*, *pars*, Lonsdale, 1850. In Dixon, Geol. Sussex, p. 307, pl. xviii B, fig. 4, *non* figs. 3, 5.
,, ,, *pars*, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 334.
,, *alternatus*, d'Orb., Vine, 1893. *Ibid.* p. 334.
Truncatula carinata (*non* Reuss), *pars*, d'Orbigny, 1854. Bry. Crét. p. 1058, pl. 797, figs. 11–15, *non* figs. 5–10.
Homœosolen carinatus, *pars*, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 334.
Truncatula subpinnata, *pars*, Vine, 1893. *Ibid.* p. 334.
Supercytis digitata, *pars*, Gamble, 1896. Cat. Bry. Chatham, p. 6.

DIAGNOSIS.

Zoarium frondescent, of crowded multipinnate branches. The branching is irregular; the branchlets cross and intersect, but do not anastomose.

The back of the distal parts of the branches is traversed by longitudinal, fluted, or carinate ridges, which form a strong median carina; but this structure may be replaced by transverse wrinkling in the proximal ends of the branches in old specimens.

Gonœcia ovoid; attached to base of the pinnules on the obverse face.

DIMENSIONS.

		B.M. D. 2948. Figd. by Lonsdale. mm.	B.M. D. 7095. Figd. No. 28, p. 86. mm.
Zoarium:	height	50 ...	10
,,	maximum width of the frond ...	65 ...	—
,,	diameter of branch (average) ...	1·5 ...	1·5–1·8
,,	width of branchlets	1 ...	—
,,	length of branchlets	— ...	—
,,	average distance of branchlets (measured from successive carinæ)...	1·75 ...	1·5
Zoœcia:	diameter	— ...	·05–·1

DISTRIBUTION.

BRITISH:

Chalk: Sussex; Charing and Northfleet, Kent; Salisbury; Guildford; Arreton Down, Isle of Wight.

Upper Chalk—Zone of *Micraster coranguinum*: Gravesend; Bromley, Kent.

Middle Chalk—Zone of *M. cortestudinarium*: Chatham.

FOREIGN:

Senonian—France. D'Orbigny gives a long list of Senonian localities, and includes in the species von Reuss's *H. carinata*, which is Cenomanian, and the two forms which are here divided between *H. ramulosus* and *H. gamblei*.

FIGURES.

Fig. 28, p. 86. A thin longitudinal section along a branch; × 10 dia. Upper Chalk: Gravesend. Harford Coll. **D. 7095.**

AFFINITIES.

This Bryozoan was included by Lonsdale in his *Homœosolen ramulosus*, to which it is undoubtedly very nearly allied, as the two forms differ mainly in the character of the branching, so that fragments cannot be very certainly determined. The differences, however, appear sufficiently well marked to require specific or varietal separation. Its most easily recognized character is the branching. In *H. ramulosus* the tendency is for the branches to be often regularly dichotomous, and for the branchlets to be usually short and taper rapidly to a blunt point, and to be given off irregularly and point in the same direction as the main stem.

In *H. gamblei*, on the other hand, the main stems give off sub-branches which are usually opposite, and they are directed at a wide angle from the main stem; and the main stem only dichotomizes after every four or five pairs of sub-branches.

The typical branching of *H. ramulosus* is shown in d'Orbigny's figures, pl. 797, figs. 5–7, and the shape of the sub-branches in his fig. 9; the branching of *H. gamblei* is shown on the same plate, figs. 11, 12, and 15.

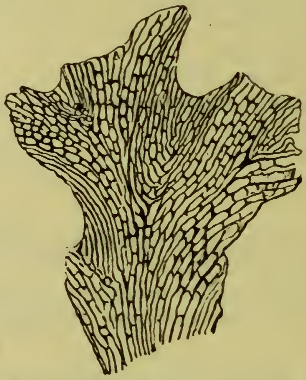

Fig. 28.—*Homœosolen gamblei*; × 10. **D. 7095.**

A second difference is that the reverse side in *H. gamblei* is generally raised into a median keel or ridge, whereas that of *H. ramulosus* is flatter. This difference is well shown in d'Orbigny's figures; his pl. 797, fig. 10, shows the flat-backed type of *ramulosus*, and the fig. 14 on the same plate shows the triangular section and ridge of *H. gamblei*. In old branches of *H. gamblei*, however, the backs of the stems are flatter and covered by a calcareous layer marked by transverse wrinkles, while some narrow branches of *ramulosus* are sub-carinate.

H. gamblei is also a near ally of *H. alternatus* (d'Orb.), which differs by having shorter lateral branches that are sharply reflexed.

The pinnate zoarium of this species has some resemblance to that of *H. disparilis* (d'Orb.), from which, however, its structure is different, as in the greater length of the sub-branches and the absence of the saw-like lateral processes of that species.

The specific separation of *H. ramulosus* and *H. gamblei* is not free from doubt. One consideration that tells against the specific value of *H. gamblei* is that d'Orbigny regarded the two as only individual variations of one species; he represented the pinnate zoaria as only the older stage of the other. Age is, however, certainly not the explanation of the differences between the two series, for the pinnate character is well developed in specimens that are much smaller than some typical forms of *H. ramulosus.* Weightier evidence against the establishment of *H. gamblei* is that some specimens of that form (e.g. one of **B. 3740**) show a tendency to a flamboyant, dichotomous branching, and that often of two specimens from the same locality (e.g. **B. 102** from Charing) one may belong to each species. In this case, however, as the material collected by Harris at Charing was obtained from the gullies in the Chalk escarpment after rain, the specimens may have come from different horizons.

Nevertheless, the difference between the well-developed forms of the two species is so marked that their separation is advisable, though *H. gamblei* may be only a variety of *H. ramulosus* with a pinnatiform zoarium. The argument which has decided me in favour of separating *H. ramulosus* and *H. gamblei* as distinct species is that the division into two types, that with hooked, irregular branches and that with a pinnate zoarium, is marked in specimens of all stages of growth. The contrast is shown in the thin terminal branches in **D. 677** (*gamblei*) and **D. 678** (*ramulosus*), and in the young basal specimens—the *Supercytis digitata* form—by **D. 668,** of which the best-preserved branch has the pinnate plan of *gamblei*, while **D. 4506** (a young form with very thin branches) and **D. 404** (with thicker and more crowded branches) have the characters of *H. ramulosus.*

The species is named after Mr. Gamble, who has collected a fine series of both it and *ramulosus,* and recognized that a part of the series belongs to a distinct variety.

LIST OF SPECIMENS.

D. 2948. A large, much branched zoarium; the front is 65 mm. wide, and some branches are 50 mm. long. Figd. by Lonsdale as *H. ramulosus.* Dixon's Geol. Sussex, pl. xviii B, fig. 4 (*non* figs. 4*b–d*). Upper Chalk. Bromley, Kent. Bowerbank Coll. The reverse is well carinate; in 17 mm. length of a branch are five branchlets on one side and six on the other.

D. 2949. The type-specimen. A small part of the base has been figured by Lonsdale in Dixon's Geol. Sussex, pl. xviii B, fig. 5*. The frond is 34 mm. high by 31 mm. wide. The branches are crowded, and the short lateral branches are occasionally not exactly opposite, and in places are not quite symmetrical in arrangement. Chalk. Sussex. Dixon Coll.

D. 7095. A longitudinal section cut through part of a basal stem from **B. 3740.** Upper Chalk. Gravesend. F. Harford Coll. Fig. 28, p. 86.

5440–2. Three specimens. Chalk. South-east of England. Mantell Coll.

38,722. Two zoaria, one with crowded growth; the other is a basal specimen showing both aspects. Upper Chalk. Northfleet. Purchased of Bryce Wright.

47,015. A young zoarium, with the main branches 10 mm. long and having four lateral branches in 6 mm. Part of it is isolated and exposes both surfaces. Chalk. Gravesend. J. Wood Coll.

B. 102. Two zoaria in flint. One is regularly pinnatifid; the other, encrusted with *Membranipora*, has a tendency to somewhat flamboyant branching. Upper (?) Chalk. Charing, Kent. Purchased of Professor T. R. Jones, F.R.S. 1881.

B. 3740. Four large frondose zoaria; in one the zoarium is 20 mm. high by 25 mm. wide; there are isolated fragments and two slides with thin sections cut from this specimen. The other is 17 mm. high and 31 mm. wide. In one the branches are crowded, and the branches are often dichotomous; it shows the broad, flattened reverse surface, with, however, the median ridge still recognizable; a small part of the obverse surface has been exposed, and shows many of the fine, pore-like apertures of the young zoœcia. In another specimen the branching is more open and the tendency is flamboyant; the back is more ridged than in the first specimen, and the young branches have no fine, pore-like apertures. Sections cut from this specimen are registered as **D. 7095** (*supra*). Upper Chalk. Gravesend. Harford Coll.

D. 501. A young zoarium, with a large elliptical basal attachment and strongly carinate posterior surface. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. W. Gamble Coll.

D. 668. A large elliptical zoarium. Form *Supercytis digitata*, attached to a cylindrical Bryozoan stem (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll., No. 74; recorded as *Homœosolen ramulosus* base.

D. 677. Two thin terminal branches, showing obverse and reverse faces and the sub-branches almost opposite; one is 5 mm. long and has four sub-branches on each side (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll., No. 79; recorded as *Truncatula subpinnata*.

?D. 680. A small fragment of branch (probably of *H. gamblei*) showing obverse face (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll., No. 78; recorded as *Truncatula carinata* (?).

D. 2650. Three fragments of branches (on slide). Upper Chalk. Salisbury. Vine Coll., Nos. 52 (?), 71; recorded as *Homœosolen carinatus* (see p. 84).

D. 2748. A branch of a zoarium 7 mm. long, with the base of five sub-branches on each side. The sub-branches are alternate at the upper end and opposite at the lower end. On slide, with a fragment and base of *H. ramulosus.* Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Vine Coll.

D. 3072. Fragment of a young zoarium. Chalk. Loc.? Toulmin Smith Coll.

D. 3951. Three specimens of var. *gamblei* on flint and one detached. The specimen is a form of *Supercytis digitata.* Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll. Purchased 1898.

?D. 4403. An imperfect zoarium. Upper Chalk. Loc.? Toulmin Smith Coll.

D. 4401. A zoarium showing the reverse surface, which is carinate. ? Gravesend. J. Brown Coll.

D. 4406. A very typical pinnatifid branch, with a long stem and four main branches. Chalk. South-east of England. Mantell Coll.

D. 4415. A fragment with the ends of three branches. Chalk. Loc.? Dixon Coll.

D. 4416. A zoarium showing obverse face and an isolated fragment (in tube). The posterior surface is less carinate than usual. Branching pinnate. Upper Chalk. Guildford. Capron Coll.

D. 4481. A zoarium, with strongly keeled reverse. Upper Chalk. Loc.? Old Coll.

D. 4490. A small zoarium, with branch of *Desmepora pinnigera*, Greg. Chalk. Dover. Wetherell Coll.

D. 7280. Four specimens in chalk; two show the bases. Chalk. Loc. Toulmin Smith Coll.

D. 7314. A branch showing the reverse surface. It is 5 mm. long and has a maximum width of 2·5 mm. There are four branches on one side and three and the base of a fourth on the other; the branches are alternate. Middle Chalk or upper part of Lower Chalk. Arreton Down, Isle of Wight. Presented by Miss Mary Salter, September 29, 1903.

D. 10,974. Base and two long branches (one is 20 mm. long) of a zoarium. Upper Chalk. Sussex. J. S. Gardner Coll.

7. **Homœosolen disparilis** (d'Orbigny), 1854.

SYNONYMY.

Semicytis disparilis, d'Orbigny, 1854. Bry. Crét. p. 1051, pl. 795, figs. 12–15.
Desmeopora ,, Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 512.
Semicytis ,, Gamble, 1896. Cat. Bry. Chatham, p. 6.
? ,, ,, Canu, 1897. Bry. St. Cal.: Bull. Soc. géol. France, ser. 3, vol. xxv. p. 749.
,, ,, Canu, 1900. Bry. Tours: C.R. Assoc. franç. Av. Sci. 1899, p. 410.
,, ,, Canu, 1903. Faune Cr. Villedieu: Bull. Soc. géol. France, ser. 4, vol. iii. p. 268.
Unicytis falcata, Gamble, 1896. Cat. Bry. Chatham, p. 6.

DIAGNOSIS.

Zoarium with long dichotomous branches, bordered by numerous short, sharply truncate pinnules, which give the branches a serrate aspect. The lower pinnules are opposite and are nearly at right angles to the branches; their length is about the same as the width of the branch; they are sometimes forked. The distal pinnules are alternate, and are shorter, pointed, and sub-triangular.

The reverse surface is well rounded and covered by crowded pores. The obverse surface rises into a sinuous ridge, which gives off the short, blunt lateral processes.

DIMENSIONS.

	B.M. D. 7281. Figd. Pl. III. Fig. 8.	60,472.
Height of zoarium	29 mm. ...	50 mm.
Maximum width of the frond	20 ,, ...	69 ,,
Diameter of stem near base	2·5 ,, ...	3·5 ,,
Length of lateral processes	2 ,, ...	1–2 ,,
Diameter of lateral processes	·5–1 ,, ...	·5–1·5 ,,
Average distance of middle of lateral processes	1·3–1·6 ,, ...	1·5–2 ,,
Diameter of zoœcia	·2 ,, ...	—
Diameter of apertures	·1 ,, ...	—

FIGURES.

Pl. III. Fig. 8. A zoarium. Upper Chalk: Gravesend. Fig. 8*a*, the whole zoarium; nat. size. Fig. 8*b*, obverse face of one branch; × 6 dia. Fig. 8*c*, the reverse face of a branch; × 6 dia. Harford Coll. **D. 7281.**

DISTRIBUTION.

BRITISH:
Upper Chalk—Zone of *Micraster coranguinum*: Gravesend.
Middle Chalk—Zone of *M. cortestudinarium*: Chatham.

FOREIGN:
Senonian—Campanian: Seine-Inférieure (Bucaille).
Coniacian: Vendôme and Villedieu, Loir-et-Cher; Ste. Christophe, Tours, and Vallières-le-Grand, Indre-et-Loire; Phelippeaux, Charente-Inférieure.
Turonian—Angoumian: Lavardin, Loir-et-Cher.
? Cenomanian: St. Calais (*fide* Canu).

AFFINITIES.

This species is allied to *H. gamblei*, Greg., but differs by the bi-serrate form of its branches. The branches bear short, crowded, thick lateral processes, which usually project from the stems almost at right angles. The character of the young zoarium, in which the branches are all in one plane instead of in the funnel-shaped *Supercytis* form of *H. gamblei*, is well shown in **D. 4367.**

LIST OF SPECIMENS.

D. 7281. A typical zoarium and two isolated fragments. Upper Chalk—zone of *Micraster coranguinum.* Gravesend. F. Harford Coll. Figd. Pl. III. Fig. 8.

60,472. A large frond (50 × 69 mm. across) with both surfaces exposed. Upper Chalk—zone of *Micraster coranguinum.* Gravesend, Kent. Purchased of E. Charlesworth, 1874.

60,342. An irregular broken zoarium, 55 mm. wide. Chalk. Loc.? Dixon Coll.

D. 4367. A young zoarium, including base and a Y-shaped branch. Identified by Mr. Gamble as *Unicytis falcata.* Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

D. 4400. A zoarium, 36 mm. high by 38 mm. wide. Upper Chalk. Gravesend, Kent. Harford Coll.

D. 4409. A small, open, irregular zoarium; obverse surface. Chalk. Loc.? Old Coll.

D. 4489. A small broken zoarium showing reverse surface, and fragments showing both surfaces. Upper Chalk — zone of *Micraster coranguinum.* Gravesend. Bowerbank Coll.

D. 7284. Four imperfect fragments. Chalk. Loc.? Toulmin Smith Coll.

8. **Homœosolen virgulosus,**[1] Gregory, 1909.

SYNONYMY.

Homœosolen virgulosa, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 62.

Truncatula tetragona, *non* d'Orb., Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 334.

Homœosolen alternatus, *pars*, Vine, 1893. *Ibid.* p. 334.

Semicytis sp. (*francqana*? d'Orb.), *pars*, Vine, 1893. *Ibid.* p. 333.

DIAGNOSIS.

Zoarium an erect, irregular tuft, which is repeatedly branched. The branching is irregularly dichotomous.

Apertures: the peristomal bundles are transversely elongated, and may occur in biserial ridges with as many as five apertures in each horizontal, transverse row. Some groups of apertures are irregularly triserial.

Reverse surface fluted.

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[1] So named from its bushy form.

DIMENSIONS.

	B.M. D. 395. Pl. III. Fig. 1.	B.M. D. 3959. Pl. II. Fig. 7.
Height of zoarium	— ...	7 mm.
Diameter of branches	1 mm. ...	1–1·5 ,,
Width of base	— ...	4·5 ,,
Peristomal bundles: length ...	·9 ,, ...	·5 ,,
,, ,, width ...	·25 ,, ...	·16 ,,
Zoœcia: diameter	·13–·16 ,, ...	·2 ,,
,, diameter of apertures	·09–·1 ,, ...	·1 ,,

DISTRIBUTION.

BRITISH:
Chalk—Zone of *Micraster cortestudinarium*: Chatham.

FIGURES.

Pl. III. Fig. 1. Reverse face of the end of a branched zoarium; × 8 dia. Middle Chalk — zone of *Micraster cortestudinarium*: Chatham. Gamble Coll. **D. 395.**

Pl. II. Fig. 7. A young worn-zoarium. Fig. 7*a*, the obverse face; × 6 dia. Fig. 7*b*, the obverse of the branch to the right and the reverse face of the longer branch; × 6 dia. Middle Chalk — zone of *Micraster cortestudinarium*: Chatham. Gamble Coll. **D. 3959.**

Pl. II. Fig. 8. A still younger zoarium. Fig. 8*a*, the obverse face; × 6 dia. Fig. 8*b*, the reverse face; × 6 dia. Middle Chalk—zone of *Micraster cortestudinarium*: Chatham. Vine Coll. **D. 689.**

AFFINITIES.

This species includes small zoaria, of which the reverse face has the aspect of *Osculipora,* as the zoœcia on that surface are raised into ridges like the fasciculi of *Osculipora.* The obverse view, however, shows that the species is an *Homœosolen,* as the apertures are distributed over the whole surface.

The species is easily distinguished from *H. ramulosus* by the bushy form of the zoarium and the sub-branches being curved outward away from the main stem, and also by the Osculiporoid arrangement of the groups of apertures.

Its nearest ally is *H. tetragonus* (d'Orb.) from the Cenomanian, which also has the Osculiporoid arrangement of the apertures in the lateral processes; but in *H. tetragonus* these apertures are in small subcircular groups and not in narrow bands. (Cf. d'Orbigny, pl. 796, fig. 11, with Cat. Pl. III. Fig. 1.)

LIST OF SPECIMENS.

D. 395. Two branches of a zoarium, with obverse side broad and uniformly covered with very numerous crowded small apertures (on slide). Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll. Purchased. Labelled *Truncatula tetragona.* Figd. Pl. III. Fig. 1.

D. 3958. A complete branched zoarium, with large ovoid gonœcium a little more than 1 mm. long. It is 4 mm. high and 7 mm. wide. Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

D. 3959. Three fragments (on slide). Middle Chalk — zone of *Micraster cortestudinarium.* Chatham. Gamble Coll. Figd. Pl. II. Figs. 7*a*, *b*. One of the fragments has the reverse surface marked by oblique rows of depressions.

D. 689. One of two specimens on this slide is a very young zoarium of this species. Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Vine Coll. Figd. Pl. II. Figs. 8*a*, *b*. Both specimens on this slide are labelled *Semicytis francqana.* The second specimen is a very young base of a *Homœosolen*, sp. indet.

D. 4088. Two zoaria in flints. One includes the base, which is 2·5 mm. in diameter; the height is 10 mm. and the diameter of the branches is 1·5 mm.; part of it shows both obverse and reverse surfaces. Middle Chalk — zone of *Micraster cortestudinarium.* Chatham. Gamble Coll., No. 7. Identified as *Homœosolen alternatus.*

D. 4087. The base of a young zoarium 5 mm. high, with a flat base 2 mm. in diameter; the branches are 1 mm. in diameter. Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll. Identified as *Truncatula alternata.*

9. **Homœosolen fenestratus** (d'Orbigny), 1854.

SYNONYMY.

Semicytis fenestrata, d'Orbigny, 1854. Bry. Crét. p. 1050, pl. 795, figs. 8–11.
,, ,, Pergens, 1889. Rev. p. 386.
,, ,, Gamble, 1896. Cat. Bry. Chatham, p. 6.
? ,, ,, Canu, 1897. Bry. St. Cal.: Bull. Soc. géol. France, ser. 3, vol. xxv. p. 749.
Truncatula subpinnata, *pars*, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 334.

DIAGNOSIS.

Zoarium of branches which divide dichotomously, and in which the lateral processes are short, alternate, or subalternate. The branching is loose and open.

The reverse side of the branches is marked by from six to eight longitudinal ribs, between which in worn specimens are large, distant pores.

Apertures cover the whole obverse surface, except in young zoaria and near the distal ends of the branches, where they open in a raised sinuous ridge; branches from the zoœcial ridge extend along the pinnules.

Gonœcium elliptical, tumid, with several apertures. Situated on the obverse surface. (In **D. 4365** it is situated near the base of the zoarium.)

DIMENSIONS.

	D'Orbigny.	Long pinnuled variety.	
		B.M. D. 3968. Pl. II. Fig. 9.	B.M. D. 4365.
	mm.	mm.	mm.
Zoarium: height	35	over 4·3	over 5
,, diameter of branches ...	2	·8	·8
,, diameter of lateral processes	·5	·37	·35–1
,, length of lateral processes	about 1	1	·5–1·5
,, average distance of pinnules	1	about 1	1·2
Zoœcia: diameter...	·09–·1	·14	·08–·14
,, diameter of apertures ...	—	·08–·1	·07–·08

DISTRIBUTION.

BRITISH:

Upper Chalk—Zone of *Micraster coranguinum*: Gravesend; Dover.
Middle Chalk—Zone of *M. cortestudinarium*: Chatham.
Chalk: Beachy Head; Caterham.

FOREIGN:

Senonian: Les Roches, Loir-et-Cher.
? Cenomanian: St. Calais, Sarthe (*fide* Canu).

FIGURES.

Pl. II. Fig. 9. Obverse face of a fragment of a zoarium of variety with long pinnules; × 11 dia. Middle Chalk—zone of *Micraster cortestudinarium*: Chatham. Gamble Coll. **D. 3968.**

Pl. II. Fig. 10. Obverse face of fragment of a zoarium with long pinnules; × 11 dia. Middle Chalk—zone of *Micraster cortestudinarium*: Chatham. Gamble Coll. **D. 3968.**

Pl. III. Fig. 5. Obverse face of the base of a zoarium with a gonœcium; × 15 dia. Middle Chalk—zone of *Micraster cortestudinarium*: Chatham. Gamble Coll. **D. 4365.**

Pl. III. Fig. 6. Obverse face of a fragment with long pinnules; × 12 dia. Middle Chalk — zone of *Micraster cortestudinarium*: Chatham. Gamble Coll. **D. 4365.**

AFFINITIES.

The first obvious character shown on d'Orbigny's figures of this species is the occurrence of pores over the reverse surface, as well as the apertures on the obverse surfaces; but the reverse pores are only due to the removal of the external surface, and they occur in any worn species of *Homœosolen*.

The two essential characters of the species are the raised sinuous ridge near the distal ends of the branches on the obverse surface and the nature of the sub-branches. They are short, subalternate or alternate, and irregular in character. The nearest ally of this species is *H. gamblei*, which differs by the greater regularity of its branching and by having a more ridged reverse surface. In the latter respect *H. fenestratus* agrees with *H. ramulosus*, but differs therefrom by not having the flamboyant arrangement of the branching and by having short sub-branches nearly at right angles to the main stems.

LIST OF SPECIMENS.

BRITISH.

D. 3968. Two fragments of variety with long pinnules, showing obverse and reverse faces (on slide). Middle Chalk — zone of *Micraster cortestudinarium*. Chatham. Gamble Coll. Figd. Pl. II. Figs. 9, 10.

D. 4365. Three fragments, one with gonœcium (on one slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll. Figd. Pl. III. Figs. 5, 6.

D. 405. Two fragments (on slide, with a *Supercytis* stage of another species). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

D. 676. A branch showing parts of both faces (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll., No. 80. Recorded as *Truncatula subpinnata*.

D. 3050. An irregular loose zoarium. Upper Chalk. Dover. Bowerbank Coll.

D. 3055. Branch of a zoarium 12 mm. long partly embedded in flint. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Presented by William Gamble, Esq., 1889.

D. 3969. A young zoarium showing both faces. Middle Chalk — zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

D. 4207. A young zoarium showing both faces. Middle Chalk — zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

D. 4483. A branched fragment. Upper Chalk. South-east of England. Toulmin Smith Coll.

D. 4484. A long branch and two isolated fragments. Chalk. Loc.? Old Coll.

D. 7134. A fragment of a large zoarium showing the obverse surface, and part of a young zoarium showing the carinate reverse face. Chalk. Caterham, Surrey. W. Ogle Coll.

D. 7279. Four fragments of zoaria. Chalk. Beachy Head. Presented by Dr. J. W. Gregory, 1899.

D. 7280. Four fragmentary zoaria. Chalk. Loc.? Toulmin Smith Coll.

60,343. A zoarium with crowded branches and long pinnules, with very prominent reverse ribs, and three isolated fragments of the same. Upper Chalk — zone of *Micraster coranguinum.* Gravesend. Dixon Coll.

FOREIGN.

D. 3733. A fragment of *Supercytis digitata* with gonœcium (on slide). Senonian. L'Arche de Lèves. Identified by M. Pergens. Gamble Coll. Purchased.

UNREPRESENTED SPECIES.

1. **alternatus** (d'Orbigny), 1854.

SYN. *Truncatula alternata*, d'Orbigny, 1854. Bry. Crét. p. 1057, pl. 797, figs. 1–4.
,, ,, Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 508.
,, ,, Pergens, 1890. Rev. p. 385.
non Homœosolen alternatus, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 334.

CHAR.—Zoarium tufted, with long dichotomous branches, which appear strongly bi-serrate owing to the short, crowded, alternate, lateral processes, which are strongly reflexed, and they are marked on the reverse side by longitudinal ribs. Zoœcia crowded; the interzoœcial spaces are few and small. There are from ten to twelve zoœcia in the width of the branch, and the lateral apertures may be serial or subserial.

DISTRIB.—Turonian: Martigues, Bouches-du-Rhône; Angoulême, Charente; Seine-Inférieure.

AFF.—This Turonian form closely resembles the Senonian Bryozoa for which d'Orbigny founded his species *Truncatula gracilis.* They may be only varieties of the same species; they both agree in having crowded, overlapping, alternate processes, which bend backward from the plane of the axis of the branch, and have well-marked longitudinal fluting on the reverse face. The *T. gracilis* of d'Orbigny, a synonym of *Homœosolen striatus* (Hag.), has longer and more slender branches, with the processes more distant than in *H. alternatus.*

2. **francqanus** (d'Orbigny), 1854.

Syn. *Semicytis francqana*, d'Orbigny, 1854. Bry. Crét. p. 1052, pl. 794,
figs. 13–15.
,, ,, Pergens, 1890. Rev. p. 386.

Char.—Probably a young *Homœosolen.*

Distrib.—Senonian: Carancy, Pas-de-Calais.

3. **falcatus** (d'Orbigny), 1854.

Syn. *Unicytis falcata*, d'Orbigny, 1854. Bry. Crét. p. 1048, pl. 794, figs. 8–12.
,, ,, Pergens, 1890. Rev. p. 385.
non ,, ,, Gamble, 1896. Cat. Bry. Chatham, p. 6.

Char.—Zoarium erect, tufted; 30 mm. wide and branches 4 mm. in diameter. The branches are round below, and bear on the middle of the upper side a single series of pointed processes; there are apertures on one side of these processes.

Distrib.—Senonian: Meudon, near Paris; Châteaudun, Eure-et-Loire; Lavardin, Lisle, Vendôme, and Villavard, Loir-et-Cher; Joué, Luynes, Maune, St. Christophe, and Tours, Indre-et-Loire; Bougniaux, Pécine, Péguillac, Pérignac, Pons, Saintes, and St. Léger, Charente-Inférieure.

Aff.—This species is a *Homœosolen*, with single aperture-bearing processes on the middle of the upper surface of the branches instead of a double series, one on each side.

4. **striatus** (von Hagenow), 1846.

Syn. *Retepora striata*, von Hagenow, 1846. In Geinitz, Grundr. Verst. vol. ii.
p. 591, pl. xxiii B, fig. 3.
Truncatula ,, von Hagenow, 1851. Bry. maastr. Kr. p. 25.
,, *truncata*, *pars*, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv.
p. 37.
,, *gracilis*, d'Orbigny, 1854. Bry. Crét. p. 1059, pl. 798, figs. 1–5.
,, ,, Canu, 1900. Bry. Tours: C.R. Assoc. franç. Av. Sci.
1899, p. 410.

Char.—Zoarium of a few widely separated, dichotomous branches, which are usually thin, being about 1 mm. in diameter. The branches bear crowded, overlapping, alternate, lateral processes, which are short and strongly reflexed, and the reverse side of each pinnule is masked by conspicuous striations. As the sub-branches are mere short processes, only the tips are seen on the obverse side.

Distrib.—Senonian—Maastrichtian: Meudon.
Campanian: Rügen.
Santonian: ? Saintes, Charente-Inférieure.
Coniacian: in the Craie de Villedieu at Vendôme, Villavard, etc., Loir-et-Cher; Tours, Joué, Luynes, etc., Indre-et-Loire.

Aff.—This species was founded by von Hagenow, who gave a figure only of the reverse face; but this agrees so precisely with the species subsequently well figured by d'Orbigny as *Truncatula gracilis* that I should have felt no doubt of their identity but for the action of Marsson. The two Bryozoa both agree in having long dichotomous branches with short alternate pinnules, which are so crowded that they appear to overlap. They are both marked by raised longitudinal lines. Marsson, however, included *Retepora striata*, Hag., as a synonym of *Osculipora truncata*, but these species appear decidedly distinct. *O. truncata* has smooth stems, and the peristomal fasciculi, though crowded, are distinctly separated by short lengths of the stems, and tend to bend out almost at right angles to the stem. It appears, moreover, improbable that von Hagenow, who knew *O. truncata* so well, should have made this mistake. Another interpretation of *R. striata* has also been accepted; for it has been regarded by some collectors as *Desmepora semicylindrica*, which is clearly distinct, as von Hagenow recorded it at the same time that he founded his *R. striata*. *Homœosolen* occurs, but it is apparently rare in the Rügen Chalk, where it is represented by the species founded by von Hagenow as *R. costata*, which is probably the same species as *H. ramulosus*.

5. **jellyæ** (Pergens), 1894.

Syn. *Truncatula jellyæ*, Pergens, 1894. Nouv. Bry. Crét. Limb.: Bull. Soc. belge Géol. vol. vii., Mém. p. 176, pl. viii. figs. 4, 4*a*.

Char.—Zoarium tufted, rising from a circular base with a slightly contracted short stem, from which rise about twelve to fifteen radial fasciculi, the bases of which unite to enclose a central cup-shaped hollow. Some of the bundles branch dichotomously, and have a ridged and longitudinally striated upper surface. The apertures open along the upper edge or end of the bundles and also over the whole lower face, there being from four to seven rows on the outer lower side of each bundle. Apertures ·1 × ·18 to ·2 mm. in diameter; those on the outer sides of the branches are somewhat lanceolate in shape. The zoarium is 4–6 mm. in diameter.

Distrib.—Senonian—Maastrichtian: Fauquemont, Limburg.

Aff.—Either the base of a *Discocytis*, or of a *Homœosolen* allied to *H. virgulosus* (cf. Pl. II. Fig. 8).

6. **kirkpatricki** (Pergens), 1894.

Truncatula kirkpatricki, Pergens, 1894. Nouv. Bry. Crét. Limb.: Bull. Soc. belge Géol. vol. vii., Mém. p. 177, pl. viii. figs. 5, 5*a*.

Char.—Zoarium tufted, with an oval base, from which rises a narrow stem, which breaks up into about twelve fasciculi, which would form a long, narrow tuft. The fasciculi contain from ten to thirty-six zoœcia and open above in triangular or oblong surfaces. The apertures on the outer sides of the branches are elliptical; the apertures are ·1 or ·11 mm. × ·14 to ·18 mm. in diameter.

Distrib.—Senonian—Maastrichtian: Fauquemont, Limburg.

Aff.—This is probably the base of a zoarium or else a young zoarium. The upper surface resembles an *Osculipora*, but the figure of the outer sides of the branches (Pergens, *op. cit.* pl. viii. fig. 5*a*) shows that it is an *Homœosolen*.

? **CYTIS**, d'Orbigny, 1854.

[Bry. Crét. p. 1046. Named after an island on the coast of Arabia.]

Diagnosis.

Osculiporidæ with an erect zoarium and square stem. Apertures on all sides of the stem, and especially in raised groups along the sides of vertical projecting crests.

Type Species.

C. lanceolata, d'Orbigny, 1854. Senonian: France.

Affinities.

The affinity of this genus is somewhat doubtful, but from d'Orbigny's figures it may be regarded as an Osculiporid in which the peristomal fascicles occur along vertical crests.

UNREPRESENTED SPECIES.

lanceolata, d'Orbigny, 1854.

Syn. *Cytis lanceolata*, d'Orbigny, 1854. Bry. Crét. p. 1047, pl. 794, figs. 4–7.
,, ,, Pergens, 1890. Rev. p. 385.

Distrib.—Senonian—Coniacian: Joué and Tours, Indre-et-Loire.

DISCOCYTIS, d'Orbigny, 1854.

[Bry. Crét. p. 1061.]

Synonyms.

Pelagia, Michelin, 1844.
Defrancia, *pars*, Bronn, 1848.

Diagnosis.

Osculiporidæ with a cupuliform zoarium, consisting of a flat base, a narrow peduncle, and a broad cup-shaped or funnel-shaped head, which is composed of numerous radiating bundles of zoœcia. The outer surface is covered with pores; the chief apertures are on the ends of the bundles; the upper surface is covered with epizoarium and longitudinal ridges.

Type Species.

Pelagia eudesi, Michelin, 1844. Cenomanian: France.

Affinities.

This zoarium resembles *Bicavea* from its general shape and the occurrence of the bundles of zoœcia opening on the upper margin of a circular cup-shaped head. The true affinities of the genus are no doubt with the Cytidæ of d'Orbigny, a section of the Osculiporidæ. It may be regarded as an Osculiporid in which the branches are short and numerous and coalesce laterally to form a cup-shaped zoarium. Among the species of *Homœosolen* it most resembles *H. falcatus* (d'Orb.). The zoarium has some resemblance to the *Supercytis* stage of *Homœosolen*, but in mature zoaria the zoœcial bundles of *Discocytis* project but a short distance above the disc and do not grow into a much branched frond.

The discoid zoarium is often similar in shape to that of *Discofascigera*; but in that genus the apertures are terminal, whereas in *Discocytis*, in addition to the terminal apertures, others are spread over the whole outer face of the zoarium.

1. **Discocytis eudesi** (Michelin), 1844.

Synonymy.

Pelagia eudesi, Michelin, 1844. Icon. Zooph. p. 123, pl. xxxii. fig. 5.
,, ,, Michelin, 1846. *Ibid.* p. 204.
,, ,, d'Archiac, 1846. Form. crét. vers. Plat. centr.: Mém. Soc. géol. France, ser. 2, vol. ii. p. 78.
,, ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 175.
Defranceia eudesi, Bronn, 1848. Ind. Pal. p. 405.
Discocytis ,, d'Orbigny, 1854. Bry. Crét. p. 1062, pl. 798, figs. 10–17.
,, ,, Pergens, 1890. Rev. p. 386.
non ,, ,, Gamble, 1896. Cat. Bry. Chatham, p. 6.
,, ,, Ulrich, 1900. In Zittel-Eastman, Textbook Palæont. vol. i. p. 265, fig. 426.
Pelagia infundibulum, Michelin, 1844. Icon. Zooph. p. 205, pl. lii. fig. 1.
,, ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 175.
Defranceia ,, Bronn, 1848. Ind. Pal. p. 405.
Pelagia insignis, Michelin, 1844. Icon. Zooph. p. 205, pl. lii. fig. 2.
Defranceia ,, Bronn, 1848. Ind. Pal. p. 405.

Diagnosis.

Zoarium with a small flat base and a narrow, short stem; the upper part is hollow and funnel-shaped. The upper surface is crossed by about twenty-five to thirty radial bundles of zoœcia, and the upper edge of each bundle is a prominent median crest. The bundles dichotomize occasionally.

Apertures in sub-elliptical groups on the tooth-like projections around the rim of the zoarium.

Dimensions.

Diameter of the zoarium	12 mm.
Height	7 ,,

Distribution.

Cenomanian: Le Mans and Bellesme, Sarthe; Villers, Calvados; Vaches Noires; Sainte-Croix, France (*fide* d'Archiac).

LIST OF SPECIMENS.

32,465. Two zoaria attached to an *Ostrea*. Cenomanian. Le Mans. L. Saemann Coll.

60,259. Seven zoaria; one variety has long ridges and the other has the apertures grouped at the ends in multiserial groups, somewhat triangular in shape. Cenomanian. Le Mans. Tesson Coll.

60,356. Two zoaria. Cenomanian—Grès Vert. Near Bellesme, Department of Orne.

D. 3673. A zoarium with a stem labelled *Eschara dichotoma*, but which is indeterminable. Cenomanian. Le Mans. Old Coll.

D. 3674. Three zoaria (in tube). Cenomanian. Department of the Sarthe. Old Coll.

D. 3675. A collection of eight zoaria; they show similar variations in the radial ridges to those that occur in *Actinopora*; one specimen, 8 mm. in diameter, has the ridges raised to the height of 3 mm. at the outer edge, and they resemble the tooth-shaped groups of *Actinopora diadema* (Goldf.). Cenomanian. Department of the Sarthe. Old Coll.

D. 3676. Three loose zoaria. Cenomanian—Grès Vert. Vaches Noires, Dives, Calvados. Tesson Coll.

D. 3677. Four zoaria (in tube). Cenomanian. Department of the Sarthe. Old Coll.

2. Discocytis profunda,[1] Gregory, 1909.

SYNONYMY.

Discocytis profunda, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. 5, vol. vi. p. 62.

DIAGNOSIS.

Zoarium very small, solid, pointed below, and expanding gradually or rapidly upward to an irregular but horizontal upper surface. The sides are coarsely ridged.

Apertures in groups on irregular blunt knobs around the margin of the upper surface; seen from above, the groups are radial and separated by irregular small zooecia.

DIMENSIONS.

	B.M. D. 2851.	
	mm.	
Diameter of zoarium ...	1·5	
Diameter of stem ...	·51	(at half the full length of the zoarium).
Height of zoarium ...	2·5	
Diameter of zoœcia ...	·12–·25	
Diameter of apertures ...	·07–·1	

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[1] So named as it probably lived at greater depths than most members of the genus.

DISTRIBUTION.

Chalk: Charing, Kent.

FIGURES.

Pl. II. Figs. 1–3. Three zoaria. Chalk: Charing, Kent. T. R. Jones Coll. **D. 2851.**

Fig. 1, a zoarium from the side; × 16 dia.

Fig. 2, another specimen from the side; × 16 dia.

Fig. 3, upper surface of another specimen; × 16 dia.

AFFINITIES.

This small species is much narrower and higher in proportion to its diameter than the typical members of the genus. It is a small form and probably grew on a soft calcareous mud, in which it was probably partly buried. It, however, agrees essentially with *Discocytis*, as the apertures open in groups on the top of blunt, irregular projections around the upper margin of the zoarium.

LIST OF SPECIMENS.

D. 2851.	The type-specimen and two paratypes with three others (on slide). Chalk. Charing, Kent. T. R. Jones Coll. Figd. Pl. II. Figs. 1–3.
60,605.	Three specimens, one of the broad, depressed variety (on slide). Chalk Marl. Kent. Purchased of P. E. Ewen, 1879.
D. 2824.	Three zoaria of the tall variety (on slide). Chalk. Charing, Kent. T. R. Jones Coll.
D. 2825.	Two zoaria of the form with short stems and more rapidly expanding head. Chalk. Charing, Kent. T. R. Jones Coll. Figd.
D. 2852.	A young zoarium (on slide). Chalk. Charing, Kent. T. R. Jones Coll.
D. 4485.	Five small zoaria of the tall variety (on slide). Chalk. Charing, Kent. T. R. Jones Coll.

UNREPRESENTED SPECIES.

1. **esseniensis,** Simonowitsch, 1871.

SYN. *Dyscocytis esseniensis*, Simonowitsch, 1871. Bry. Ess. Grüns.: Verh. nat. Ver. preuss. Rheinl. vol. xxviii. pp. 61–3, pl. iii. figs. 2*a–e*.

CHAR.—Zoarium fungiform or funnel-shaped, with a depression in the middle of the upper surface. Zoarium about 4 mm. high; upper surface 6–9 mm. in diameter; stem 1–1·5 mm. in diameter. About seven primary zoœcial bundles, which form raised ridges on the upper surface; they branch and end in fourteen sub-triangular groups of apertures, containing about six to ten apertures in each group.

DISTRIB.—Cenomanian—Greensand: Essen, Germany.

2. irregularis, Marsson, 1887.

Syn. *Discocytis irregularis*, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv. pt. i. p. 42, pl. iv. fig. 1.

Char.—Zoarium irregular in form; margin often deeply embayed; upper surface irregularly convex; underside flat; radial bundles of few zoœcia; the apertures are near the margin and usually open in biserial ridges. Gonœcia on under surface smooth, hemispherical.

Distrib.—Senonian—Campanian: Rügen.

Aff.—Marsson says it is allied to *D. esseniensis*, Simon.

STEPHANODESMA, Hamm, 1881.

[Bry. mastr. Ob.-Sen. i., Cycl. p. 34.]

Diagnosis.

Osculiporidæ (?) with the zoœcia grouped in simple or branching bundles, which radiate from the base and are arranged to form a low, goblet-shaped zoarium.

The apertures open only on the outer sides of the zoœcial bundles.

Type Species.

Stephanodesma bifurcatum, Hamm. Senonian—Maastrichtian: Maastricht.

Affinities.

This Bryozoan may be an Osculiporid in which the branches are arranged so as to form a goblet-shaped zoarium; in that case it would be a very close ally of *Discocytis*, of which the zoarium is often funnel-shaped. The genus may, however, be one of the Fascigeridæ, as the zoœcia are said to open on the outer sides of the zoœcial bundles; if that statement means that the apertures are confined to the bundles, and are merely sub-terminal instead of terminal, then the genus would be a close ally of *Discofascigera*. It appears, however, more probable that the apertures are mainly lateral and the affinities with *Discocytis*.

UNREPRESENTED SPECIES.

bifurcatum, Hamm, 1881.

Syn. *Stephanodesma bifurcata*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 34.

Char.—Zoarium consists of about seven radial, lowly inclined branches, which consist of short, thick bundles that subdivide once or twice. Apertures in longitudinal rows of about five. Upper surface smooth, though marked with fine lines.

Distrib.—Maastrichtian: Maastricht. (Fairly abundant.)

BICAVEA, d'Orbigny, 1853.

[Bry. Crét. 1853, p. 955.]

SYNONYMY.

Fasciculipora, pars, d'Orbigny, 1850.
Radiopora, pars, Pergens & Meunier, 1887.
Lichenopora, pars, Pergens, 1890; Hennig, 1894.
Multicrisina, pars, d'Orbigny, 1853; Pergens, 1890.

DIAGNOSIS.

Osculiporidæ with the zoarium in the form of a capitulum; it has a cylindrical or conical peduncle, surmounted by a solid, discoid head, from the margins of which diverge many radial fasciculi or ridges, or cog-like teeth.

Stem surface perforate or imperforate.

DISTRIBUTION.

Cretaceous: Danian to Turonian.

TYPE SPECIES.

Fasciculipora urnula, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 268. Senonian: France.

AFFINITIES.

The name *Bicavea* suggests that this genus is an ally of *Discocavea*, *Reptocavea*, and the rest of that series. But the normal zoœcia are fasciculate, and the bundles are separated by an intermediate mass of zoœcia which are subordinate to the zoœcia in the fasciculi. *Bicavea* is an Osculiporoid with a capitate zoarium, armed with spike-like zoœcial bundles. Its nearest ally is *Discocytis*, which is mainly Cenomanian and is probably the ancestor of *Bicavea*.

Bicavea rotaformis,[1] Gregory, 1907.

SYNONYMY.

Bicavea rotaformis, Gregory, 1907. Rotif. Bry. Isle of Wight: Geol. Mag. dec. v. vol. iv. p. 442.
,, ,, Rowe, 1908. Zones of Chalk.—V. Isle of Wight: Proc. Geol. Assoc. vol. xx. pp. 220, 235, 263, 284, 300.
Defrancia diadema, aff., Bristow, 1889. Geol. Isle of Wight, 2nd ed., p. 272.

DIAGNOSIS.

Zoarium simple or compound, with a narrow cylindrical stem, attached in a circular concavity in the lower part of the body.

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[1] Shaped like a cog-wheel.

The body of the zoarium is discoid, or wheel-shaped, and has on the margin a series of vertical radial projections as in a cog-wheel. The cogs usually project for a distance nearly equal to the radius of the disc. The cogs may be prolonged at their upper, outer corner into spike-like fasciculi. The upper surface between the bases of the fasciculi is depressed, and occupied by the small, crowded, irregular apertures of the intermediate, subordinate zoœcia.

Stems appear solid and imperforate, as they are covered by a lamina, which is fluted vertically or wrinkled horizontally. Two zoaria may arise from one stem, or several zoaria may arise from a stolon.

DIMENSIONS.

	B.M. D. 2297. mm.	B.M. D. 2296. mm.
Diameter of body across central disc	3	3·5–3·75
Diameter of body, including projections	5	6–7
Length of stem	2	—
Diameter of stem	·8–1	1
Zoœcia: diameter	—	·15–·17
,, diameter of aperture	·08	·08–·1
Number of fasciculi	—	8–9

DISTRIBUTION.[1]

Lower Chalk (Turonian)—near base of the *Holaster planus* zone: Isle of Wight, at Freshwater, on the Military Road; Compton Bay; Culver Cliff; Shalcombe Down (Pit No. 13); Arreton Down (Pit Nos. 19 and 20); Brading Down (Pit. No. 37); Carisbrooke (Pit No. 51). Mupe Bay, Dorset.

FIGURES.

Pl. II. Fig. 4. The upper surface of a zoarium; × 8 dia. Chalk: near Freshwater, Isle of Wight. Capron Coll. **D. 2996.**

Pl. II. Fig. 5. The lower side of another zoarium; × 7 dia. Chalk: near Freshwater, Isle of Wight. Capron Coll. **D. 2996.**

Pl. II. Fig. 6. Two zoaria joined by a common stem; × 6 dia. Chalk. Loc. unknown. Old Coll. **D. 2997.**

AFFINITIES.

This species is very well marked. It has long been well known to collectors from the Isle of Wight, and has been described as the

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[1] From information kindly supplied by Dr. A. W. Rowe.

"rotiform Bryozoon."[1] Its distribution has been worked out by Dr. A. W. Rowe,[2] who has proved that, like so many other Bryozoa, it has a well-defined zonal value, and that it is restricted to the lower part of the *Holaster planus* zone. The nearest allies of this species are some specimens from the Danian Chalk of Faxoe described as *Radiopora urnula*,[3] var. *stipitata*, by Pergens & Meunier in 1887; the authors divided that species into three varieties, of which the form *stipitata* has a narrow stem and discoid head like the English specimens. Some workers at Bryozoa would no doubt include the Danian, the French Maastrichtian, and the British Turonian varieties as all members of one species, which would then have the name *B. urnula* (d'Orb.).[4] But the differences between the specimens from these three horizons seem adequate for their specific separation. The *B. urnula*, the type species of the genus, has a vasiform body, which is convex below and passes gradually into the short stem, while the apertures of the zoœcia are on tufts or radial keel-like plates projecting above the body. *B. rotaformis*, the oldest representative of the genus, has a wheel-shaped body on a narrow stem, and the apertures are on vertical teeth on the sides of the body. The Danian forms are very variable in form; the stem is longer and narrower than in *B. urnula*, but it still passes by a gradual expansion into the body; the usual form of the zoarium is more piriform than in *B. rotaformis*. Further differences are that in the Danian forms the stem is perforate, and the apertures of the zoœcia open on ridges which project but slightly from the disc; in a specimen of var. *stipitata* one ridge projects upwards as one of the spine-like processes so characteristic of the genus. Though *B. rotaformis* is variable, the lower side of the body is apparently always concave, whereas in the Danian forms—which I regard as a distinct species with the name *B. pergensi*—and in *B. urnula* the base is always convex. Both Dr. Rowe and Mr. C. D. Sherborn, who have collected a considerable number of specimens of *B. rotaformis*, tell me that they have not seen one with a vasiform body, and my more limited experience has been the same.

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[1] A. W. Rowe. "The Zones of the White Chalk of the English Coast.—II. Dorset": Proc. Geol. Assoc. 1901, vol. xvii. pt. i. pp. 23, 46.

[2] Zones of Chalk.—V. Isle of Wight: *ibid.* vol. xx. pp. 220, 284, 300, etc.

[3] *Radiopora urnula*, Pergens & Meunier: Bry. gar. Faxe: Ann. Soc. mal. Belg. vol. xxi. pp. 224–6, pl. ix. figs. 1–5; pl. x. fig. 6.

[4] *Fasciculipora urnula*, d'Orbigny, 1850: Prod. Pal. vol. ii. p. 268. *Bicavea urnula*, d'Orbigny, 1853: Bry. Crét. p. 956, pl. 776, figs. 1, 2.

LIST OF SPECIMENS.

D. 2996. Two zoaria, one showing upper and one the lower surface. Lower Chalk (Turonian). Near Freshwater, Isle of Wight. Capron Coll. Figd. Pl. II. Figs. 4, 5.

D. 2997. Two zoaria rising from the same stem. Lower Chalk. Loc.? Old Coll. Figd. Pl. II. Fig. 6.

D. 4581. Two zoaria (on slide); the larger has nine cogs. Lower Chalk (Turonian). Near Freshwater, Isle of Wight. Capron Coll.

D. 4580. A zoarium with seven cogs (on slide). Lower Chalk (Turonian). Near Freshwater, Isle of Wight. Capron Coll.

D. 2280. Two zoaria (on slide). Lower Chalk (Turonian). Culver, Isle of Wight. Presented by Dr. W. F. Hume, F.G.S., May, 1896.

D. 2998. Three zoaria on chalk. Lower Chalk. Loc.? Old Coll. One is the largest specimen in the collection; it measures 7 mm. across the capitulum. The longest stem is 3 mm. in height.

D. 3047. Three zoaria. Lower Chalk (Turonian). Near Freshwater, Isle of Wight. J. S. Gardner Coll.

UNREPRESENTED SPECIES.

1. costata (d'Orbigny), 1853.

Syn. *Multicrisina costata*, d'Orbigny, 1853. Bry. Crét. p. 922.
,, ,, Ubaghs, 1879. Descr. Géol. Paléont. Limb. p. 224.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 46.

Char.—Allied to *Bicavea cupula* (d'Orb.), but provided with ten large prominent crests ('côtes') on the upper surface. Hamm includes it in his list of 'dubia.' According to the description it appears to resemble the *dilatata* form of *B. urnula*, but with less numerous vertical plates.

Distrib.—Senonian—Maastrichtian: Maastricht and Ciply, Belgium.

2. cupula (d'Orbigny), 1853.

Syn. *Multicrisina cupula*, *pars*, d'Orbigny, 1853. Bry. Crét. p. 921, pl. 770, figs. 9, 10, *non* figs. 6–8.
,, ,, ,, Pergens, 1890. Rev. p. 383.
Radiopora urnula, *pars*, Pergens & Meunier, 1887. Bry. gar. Faxe: Ann. Soc. mal. Belg. vol. xxi. pp. 224, 226.

Char.—Zoarium compound; composed of funnel-shaped or piriform segments, each with a short stout peduncle, about one-third the diameter of the body; each sub-colony has a ring of about ten low, blunt, lobe-like tufts along the edge of the upper surface.

Distrib.—Senonian—Maastrichtian: Meudon, near Paris.

Aff.—This species is characterized by the lobate shape of the ridges on the margin of the body occupied by the apertures; it most nearly resembles *Bicavea pergensi*, in which the ridges bearing the apertures are more numerous and less wide. The zoarium of the larger specimen figured by d'Orbigny may be regarded as three or more *Bicavea*, growing in a vertical series. D'Orbigny included in this species a flat discoid zoarium with a short lateral stem like *Orbitulipora petiolus*, Greg.,[1] from the British Eocene. M. Pergens in 1886 included the species as specifically identical with *B. urnula*. He subsequently receded to the perhaps unnecessarily extreme position of separating them generically.

3. **pergensi**, Gregory, 1907.

SYN. *Radiopora urnula, pars*, Pergens & Meunier, 1887. Bry. gar. Faxe: Ann. Soc. mal. Belg. vol. xxi. p. 224, pl. ix. figs. 1–5; pl. x. fig. 6.

Lichenopora ,, ,, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 34.

Bicavea pergensi, Gregory, 1907. Rotif. Bry. Isle of Wight: Geol. Mag. dec. 5, vol. iv. p. 443.

DIAGNOSIS.—Zoarium with the stem, when present, covered with apertures. The apertures on the body open on vertical ridges, which project slightly above the central part of the body. The apertures on these ridges are biserial to quadriserial, and are quincuncial in arrangement. The ridges may project at their upper corner into spikes. The form is very variable; it is irregular, and the zoarium sessile, with the ridges projecting upward into spikes, in var. *sessilis*, P. & M. The form is piriform in var. *intermedia*, P. & M.; it has a cylindrical stem which expands rapidly to the body of the zoarium in var. *stipitata*, P. & M.

DISTRIB.—Danian: Faxoe; Annetorp, Sweden.

AFF.—This variable species differs from the British Turonian species, *B. rotaformis*, Greg., by the convex base, perforate stem, and lesser development of the lateral ridges around the body of the zoarium. It differs from the French Maastrichtian species *B. urnula* (d'Orb.) by not having the vasiform head of that species; the form *intermedia* approaches to *B. urnula*, var. *dilatata*, in this respect, but the apertures in *B. pergensi* are in vertical series down the sides of the body, and although these ridges may project upward as short spines, they do not form the high spines or erect keel-like plates of *B. urnula*. The var. *stipitata*, P. & M., as figured *op. cit.* pl. ix. fig. 1, is here selected as the type of the species.

4. **urnula** (d'Orbigny), 1850.

SYN. *Fasciculipora urnula*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 268.

Bicavea ,, d'Orbigny, 1853. Bry. Crét. p. 956, pl. 776, figs. 1, 2.

,, (*Lichenopora*) *urnula*, Rowe, 1908. Zones of Chalk.—V. Isle of Wight: Proc. Geol. Assoc. vol. xx. p. 302.

Radiopora urnula, pars, Pergens & Meunier, 1887. Bry. gar. Faxe: Ann. Soc. mal. Belg. vol. xxi. p. 224.

Lichenopora ,, Pergens, 1890. Rev. p. 383.

Bicavea dilatata, d'Orbigny, 1853. Bry. Crét. p. 956, pl. 776, figs. 3, 4.

Multicrisina cupula, pars, Pergens & Meunier, 1887. *Op. cit.* pp. 224, 226.

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[1] Gregory. Brit. Pal. Bry.: Trans. Zool. Soc. 1893, vol. xiii. p. 253, pl. xxxi. figs. 12–14.

Char.—Zoarium of a narrow peduncle and swollen vase-shaped body, from the upper edge of which rise a series of seven tufts (*urnula*), or sixteen to eighteen radial vertical plates with multiserial apertures on the vertical edge (*dilatata*). The stem is covered with apertures.

Distrib.—English: Upper Chalk—Zone of *Micraster coranguinum*: Isle of Wight. Foreign: Senonian — Maastrichtian: Fécamp, Seine-Inférieure; Meudon, near Paris; Sainte-Colombe, Manche.

Aff. — M. Pergens has united d'Orbigny's species, and as he has had the opportunity of studying the type-specimens, it seems advisable to accept his decision; for both *urnula* and *dilatata* have vasiform bodies, the difference between them being that in the latter the body is much broader in proportion to its height; correlated to this flattening is the change of the groups of apertures from cylindrical spikes to radial vertical plates; the apertures in both occur above the body and not in vertical series down its side. Pergens & Meunier, in their memoir on the Faxoe Bryozoa, included *Multicrisina cupula* in this species as an individual subdivided into three sub-colonies; M. Pergens later, in 1890, however, adopted what seems to me the sounder view of separating the two species, *B. cupula* and *B. urnula*.

Suborder CANCELLATA, Gregory, 1896.

[For Diagnosis and reference see Vol. I. pp. 359–60.]

Family DESMEPORIDÆ.

Synonyms.

Cytisidæ, *pars*, d'Orbigny, 1854; *pars*, Pergens, 1890.
Osculiporidæ, *pars*, Marsson, 1887.
Fascigeridæ, *pars*, Ulrich, 1900.

Diagnosis.

Cyclostomata Cancellata with a branched zoarium; the branches are fascicular in structure, and the apertures open in groups on the ends of lateral processes or tufts along the stems.

Affinities.

The Bryozoa referred to this new family comprise those of the Cytisidæ of d'Orbigny, in which the zoarium is cancellate in structure. It therefore includes most of *Semicytis* and one species of his *Truncatula*; most of the Cytisidæ are, however, non-cancellate, and belong to the Osculiporidæ.

This family is allied to the Horneridæ, as most of its members have an erect dendroid zoarium, and as the apertures open either only on the obverse face or also on the sides of the stems. In some cases the apertures are in horizontal rows, as in *Hornera*. The family differs from the Horneridæ by its fascicular structure, and by its peristomal bundles projecting as tufts above the general surface of the stems.

DESMEPORA, Lonsdale, 1850.

[In Dixon, Geol. Sussex, p. 281.]

SYNONYMY.

Desmeopora,[1] Lonsdale, 1850 ; *pars*, Ulrich, 1900.
Desmepora, von Reuss, 1872 ; Marsson, 1877 ; *pars*, Bucaille, 1890 ; Hennig, 1894.
Idmonea, *pars*, Römer, 1840 ; Mantell, 1844.
Retepora, *pars*, von Hagenow, 1846.
Osculipora, *pars*, d'Orbigny, 1850.
Truncatula, *pars*, d'Orbigny, 1854 ; Winkler, 1864.
Semicytis, *pars*, Marsson, 1887.

DIAGNOSIS.

Desmeporidæ in which the zoarium grows as tufts of dichotomizing branches, which consist of a central core of zoœcia, surrounded by a cancellate layer. Alternate bundles of zoœcia rise from the central core, and their apertures open in groups at the margin of the obverse face; they are separated by wide areas, covered by cancelli.

TYPE SPECIES.

Idmonea semicylindrica, Römer, 1840 : Verst. nordd. Kr. p. 20, pl. v. fig. 21. Senonian : Germany.

AFFINITIES.

This genus differs from the Osculiporidæ by the possession of the external cancellate zone. The form of the zoarium resembles *Homœosolen* among the Osculiporidæ, but *Desmepora* is widely separated from that genus, as its structure is cancellate.

1. Desmepora semicylindrica (Römer), 1840.

SYNONYMY.

Idmonea	*semicylindrica*,	Römer, 1840. Verst. nordd. Kr. p. 20, pl. v. fig. 21.
Retepora	,,	von Hagenow, 1846. In Geinitz, Grundr. Verst. vol. ii. p. 591.
Desmeopora	,,	Lonsdale, 1850. In Dixon, Geol. Sussex, p. 281, pl. xviii A, figs. 6–6*e*.
non Desmepora	,,	von Reuss, 1872–3. Bry. unt. Quad. : Palæontogr. vol. xx. pt. i. p. 123, pl. xxx. figs. 6–8.
,,	,,	Marsson, 1887. Bry. Rüg. : Pal. Abh. vol. iv. p. 37, pl. iii. fig. 11.

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[1] As von Reuss and Marsson have pointed out, the name comes from δέσμη, a 'bundle,' not from δεσμός, a 'bond' or 'fetters'; so that *Desmepora* is the correct form.

Desmepora semicylindrica, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskr. vol. xxx., Acta Physiogr. No. viii. p. 30.
,, ,, Canu, 1900. Bry. Tours: C.R. Assoc. franç. Av. Sci. 1899, p. 40.
Truncatula ,, Kade, 1852. Los. Verst. Schanzenb. p. 31.
,, ,, *pars*, Boll, 1852. Geogn. Mekl.: Arch. Ver. Naturg. Meklenb. vol. vi. p. 63.
,, ,, d'Orbigny, 1854. Bry. Crét. p. 1054.
Idmonea dixoniana, Mantell, 1844. Med. Creat. vol. i. pp. 284, 287–8, figs. 6, 12.
,, *cretacea* (*non* Edw.), Mantell, 1854. *Ibid.*, 2nd ed., vol. i. pp. 268, 271, figs. 6, 12.
Osculipora truncata, *pars*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 267.
Truncatula ,, *pars*, Winkler, 1864. Mus. Teyl., Cat. Pal. livr. ii. p. 207.

DIAGNOSIS.

Zoarium of long branches, which dichotomize rarely. The obverse surface is flat and the reverse rounded. The branches are usually somewhat sinuous and gracefully curved.

The lateral tufts may end in a sharp point or they may be low and flat-topped. The areas between the zoœcial tufts are occupied by sharp, intersecting ridges separated by pores. The average number of apertures in a zoœcial tuft is about eight, and the tufts are usually a millimetre apart.

DIMENSIONS.

	Römer's type.	Lonsdale's specimen.	B.M. D. 503.
	mm.	mm.	mm.
Length of branch	7	Zoarium 25 high × 40 wide.	—
Diameter of branch	1·75	2–2·5	1·25–1·7
Diameter of peristomal group ...	—	·5	·2–·4
Length of peristomal group ...	—	·5–1	·6–·8
Diameter of apertures	—	about ·1	·06–·08

DISTRIBUTION.

BRITISH:

Upper Chalk: Bromley.
Middle Chalk—Zone of *Micraster cortestudinarium*: Chatham.
Lower Chalk—Zone of *Holaster planus*: Dover.
Chalk (zone not stated): Offham Pit, Lewes; near Maidstone; Beachy Head; Charing.

Foreign:
Senonian: Gehrden; near Le Mans (?).
Campanian: Rügen. Zone of *Belemnitella mucronata*: Qvarnby, Stafversvad, and Hemmingslycke; beds with *Actinocamax mamillatus*: Balsberg, V. Olinge, Karlshamm, Ö. Karup, etc., Sweden.
Coniacian: Tours.

Figures.

Fig. 29. A thin medial section along a branch, showing the bases of the lateral processes and the cancellate structure of the main mass of the stem; × 12½ dia. Middle Chalk—zone of *Micraster cortestudinarium*: Chatham. Gamble Coll. **D. 503.**

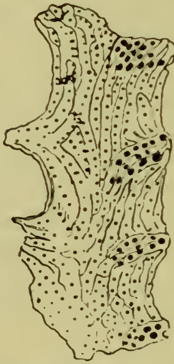

Fig. 29.—*Desmepora semicylindrica*; × 12·5. **D. 503.**

Affinities.

This species, the type of the genus, is common and well characterized. Its abundance in the Chalk of Rügen has led some collectors to regard it as von Hagenow's *Retepora striata*, which appears, however, to be clearly a *Homœosolen* (*vide antea*, p. 97), though the original figure is small and somewhat crude. As von Hagenow recorded *D. semicylindrica* from Rügen as well as his *R. striata*, the two species are probably quite distinct.

LIST OF SPECIMENS.

British.

D. 2946. Lonsdale's type-specimen. Chalk. Dover. Dixon Coll. Figd. Dixon, Geol. Sussex, pl. xviii a, fig. 6.

B. 4477. Paratype. Part of a branch showing an oblique transverse section. Chalk. Dover. Dixon Coll. Figd. *ibid.* pl. xviii a, fig. 6*d*.

B. 4478. Paratype. The end of a branch. Chalk. Dover. Dixon Coll. Figd. *ibid.* pl. xviii A, fig. 6*a*.

B. 4479. Paratype. One branch of a zoarium. Chalk. Dover. Dixon Coll. Figd. *ibid.* pl. xviii A, fig. 6*b*.

D. 503. Zoarium and two slides, giving longitudinal and transverse sections. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. W. Gamble Coll. Fig. 29, p. 112.

B. 111. A large branched zoarium with highly raised fasciculi. Chalk. Page's Pit, Charing, Kent. Professor T. R. Jones Coll.

D. 390. Three fragments on slide; one has very high fasciculi. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

D. 391. Three fragments on slide. Diameter of branches 3 mm. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

D. 392. Three fragments on slide. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

D. 393. Three fragments on slide. One shows the end of a branch, of which the last 3 mm. have no lateral fascicule. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

D. 472. A cross-shaped zoarium with broad branches and a wide central groove. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

D. 685. Four fragments on slide. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll., No. 71.

D. 686. Four fragments on slide. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll., No. 70* in Vine's List.

D. 2744. A thin branch on a slide. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll.

D. 2745. Four fragments on a slide. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll.

D. 2747. A branch on a slide. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll.

D. 3032. A slab of chalk, 18 cm. long, bearing many branches. Chalk. Offham Pit, Lewes. Capron Coll.

D. 3048. Numerous branches of a thick zoarium in chalk. Upper Chalk. Bromley. Bowerbank Coll.

D. 3049. Two zoaria: one shows the terminations of the branches, and the lateral tufts of the zoœcia are much raised and sharply pointed. Upper Chalk. Dover. Bowerbank Coll.

D. 3051. Parts of a large zoarium, in chalk, with a *Micraster*. Upper Chalk. Loc.? Old Coll.

D. 3068. Upper Chalk. Loc.? Toulmin Smith Coll.

D. 3069. Numerous branches in chalk and fragments. With *Reticrisina obliqua* (d'Orb.). Upper Chalk. Near Maidstone. Toulmin Smith Coll.

D. 3948. Numerous branches in chalk, showing sections in various directions; and some basal branches without fasciculi, and with others highly raised. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

D. 3949. A few branches of a zoarium, showing numerous sections in different directions. Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

D. 4344. A zoarium in flint. Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

D. 4380. A zoarium in chalk. Lower Chalk—zone of *Holaster planus.* Dover. Presented by William Hill, Esq., F.G.S.

D. 4381. Another zoarium with less raised fasciculi. Chalk—zone of *Holaster planus.* Dover. Presented by William Hill, Esq., F.G.S.

D. 4411, D. 4412. Three specimens. Chalk. Dover. Old Coll.

D. 7285. A long branch in chalk. Upper Chalk. Loc. ? Toulmin Smith Coll.

D. 11,797. Upper Chalk. Beachy Head. Presented by Dr. J. W. Gregory.

FOREIGN.

D. 5802. A fragment on slide. Senonian. Rügen. A. Laur Coll.

D. 6308. A fragment on slide. Senonian. Rügen. A. Laur Coll.

D. 6309 A fragment on slide. Senonian. Rügen. A. Laur Coll.

D. 6310. A fragment on slide. Senonian. Rügen. A. Laur Coll.

60,384. A zoarium. "Chalk." Near Le Mans (?). Tesson Coll.

2. **Desmepora blackmorei**, Gregory, 1909.

SYNONYMY.

Desmepora blackmorei, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. 5, vol. vi. p. 62.

DIAGNOSIS.

Zoarium of flat, broad branches. The apertures open on the ends of short ridge-like lateral processes, which project along the sides of the stems; these lateral processes are irregularly elliptical; the apertures are generally biserial, with about eight apertures in each row, and the series are placed horizontally.

The reverse surface is covered by crowded rows of small round pores (cancelli), and the surface is slightly concave.

DIMENSIONS.

	mm.
Length of branch of type-specimen	14
Diameter of branches	5 wide × 2·5 thick
Length of pinnules	about 5
Vertical width of pinnules	,, 5
Horizontal width of pinnules	,, 8
Distance of centres of adjacent lateral processes...	1–1·2
Diameter of apertures	·1–·15

DISTRIBUTION.

Upper Chalk — Zone of *Actinocamax quadratus*: East Harnham, near Salisbury.

FIGURES.

Pl. III. Fig. 9. The type-specimen. Fig. 9*a*, part of the obverse surface; × 6 dia. Fig. 9*b*, part of the side of a branch showing the ends of the pinnules and the groups of apertures; × 6 dia. Upper Chalk—zone of *Actinocamax quadratus*: East Harnham, near Salisbury. **D. 4328.**

AFFINITIES.

This species is founded on an excellent specimen originally collected by Dr. H. P. Blackmore, F.G.S. The species differs from *D. semicylindrica*, by having the apertures on the ends of the tufts in the same plane as the width of the stems. They resemble transverse rows rather than bundles. The apertures are placed on the pinnules in two rows resembling the arrangement of *Idmonea*. The stems are wider and flatter than in *D. semicylindrica.*

D. 4328. The type-specimen. Upper Chalk—zone of *Actinocamax quadratus*: East Harnham, near Salisbury. Gamble Coll. Figd. Pl. III. Fig. 9.

3. Desmepora pinnigera,[1] Gregory, 1909.

SYNONYMY.

Desmepora pinnigera, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. 5, vol. vi. p. 63.

DIAGNOSIS.

Zoarium composed of short, thick, somewhat swollen branches, which rarely subdivide, and are frequently arranged in a cross. There may be five arms.

The zoarium is attached by a short peduncle and base. The sides are marked by a series of ridges, which extend across the whole width of the side.

Apertures arranged along the lateral ridges; the apertures are biserial or rarely triserial, and there are usually from five to seven in each row. Obverse face of the zoarium concave.

The spaces between the raised groups are marked by rows of small round pores (cancelli) between horizontal ribs.

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[1] *Pinniger*, 'finned,' the lateral appendages occurring as flat, broad plates and not as pinnules.

DIMENSIONS.

	D. 7282. Pl. IV. Fig. 1.
Diameter of zoarium	17 mm.
Length of branches	8 ,,
Maximum diameter	1·5 ,,
Length of lateral processes	about ·6 ,,
Length of the series of apertures	1 ,,
Width of the series of apertures	·4 ,,
Number of apertures in each group	10–15 ,,
Distance of central lines of adjacent lateral processes	·8 ,,

DISTRIBUTION.

Upper Chalk: Beachy Head; Dover; Burham, Kent; Sussex.
Middle Chalk—Zone of *Micraster cortestudinarium*: Chatham; Rochester.
Lower Chalk—Zone of *Holaster planus*: Dover.

FIGURES.

Pl. IV. Fig. 1*a*. The zoarium of the type-specimen; natural size. Fig. 1*b*, part of one branch; × 7 dia. Middle Chalk: Rochester. J. Simmonds Coll. **D. 7282.**

AFFINITIES.

This form of *Desmepora* is fairly common in the Kentish Chalk. The species is characterized by its small simple zoarium with usually four or five simple branches. Its nearest ally is *D. blackmorei*, with which it agrees in the idmoniiform arrangement of the apertures; but in *D. pinnigera* the apertures are in longer and more regular horizontal series, and the lateral processes are separated by wider spaces.

The biserial lateral apertures suggest a comparison with the genus *Bitubigera*, which is, however, an Idmonid, having no cancellate interspaces between the groups of apertures.

LIST OF SPECIMENS.

D. 7282.	The type, a cross-shaped specimen on flint. Middle Chalk. Rochester. J. Simmonds Coll. Figd. Pl: IV. Fig. 1.
D. 409.	A single branch (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.
D. 415.	Two branches (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.
D. 710.	A fragment of a branch (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll., No. 68*a*.
D. 711.	Two fragments (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll.

D. 3071. An irregularly cross-shaped zoarium, showing the lower or obverse face and stem. Chalk. South-east of England. Toulmin Smith Coll.

D. 3074. A cross-shaped zoarium, showing both faces and side. Chalk. South-east of England. Toulmin Smith Coll.

D. 3081. A branch (on flint). Upper Chalk. Burham, Kent. Presented by Hon. R. Marsham, 1878.

D. 3085. Branches in chalk, with *Petalopora costata* (d'Orb.) and *Petalopora pulchella* (Röm.). Chalk. Dover. Bowerbank Coll.

D. 3111. A five-armed specimen. Chalk. Dover. Old Coll.

D. 4251. A branch (on flint). Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

D. 4352. A single branch (on flint). Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

D. 4384. A five-rayed zoarium. Chalk—zone of *Holaster planus* ('*Micraster breviporus*'). Dover. Presented by William Hill, Esq., F.G.S.

D. 4490. A zoarium in chalk, with *Homœosolen gamblei*, Greg. Chalk. Dover. ? Wetherell Coll.

D. 4570. Several branches in chalk, with *Clausa globulosa* (d'Orb.). Upper Chalk. Dover. Bowerbank Coll.

D. 4571. Three broken zoaria. Upper Chalk. Dover. Bowerbank Coll.

D. 4577. A five-armed zoarium. Chalk. ? Sussex. Dixon or Bowerbank Coll.

D. 4578. Several branches in chalk with *Nodelea durobrivensis*, Greg. Chalk. South-east of England. Toulmin Smith Coll.

D. 4579. Two small zoaria. Chalk. South-east of England. Toulmin Smith Coll.

D. 7286. A zoarium and broken branches. Chalk. Loc. ? Toulmin Smith Coll.

D. 7287. Three specimens. Upper Chalk. Beachy Head. Presented by Dr. J. W. Gregory.

UNREPRESENTED SPECIES.

reussi, Gregory, 1909.

Syn. *Desmepora reussi*, Gregory, 1909. New Cret. Bry. : Geol. Mag. dec. 5, vol. vi. p. 63.
,, *semicylindrica*, von Reuss, 1872. Bry. unt. Plän. : Palæont. vol. xx. pt. i. p. 123, pl. xxx. figs. 6, 7, *non* fig. 8.
,, (*Semicytis*) *fenestrata*, Marsson, 1887. Bry. Rügen : Pal. Abh. vol. iv. p. 38.

Diagnosis.—The branches are large, thick, and irregular, and form a short, stout, bushy zoarium. The peristomal groups project as large blunt knobs ; they are usually elliptical or subcircular, and each contains up to thirty to fifty apertures. The groups are scattered irregularly over the stems, occurring on the front as well as on the sides. General surface ornamented with long ribs separating the cancelli.

DIMENSIONS.	mm.	mm.
Height of zoarium	12	7
Width of zoarium	7	7
Diameter of stems	1–1·5	1
Diameter of peristomal groups	·7	·6–·7
Diameter of apertures	probably ·1	—

DISTRIB.—Cenomanian—Unter Pläner: Plauen, Saxony.

AFF.—This species differs emphatically from *D. semicylindrica* by its thicker branches and the less regular distribution of the groups of apertures. Instead of the apertures occurring in small groups, arranged in two lines, one along each side of the stem, they are irregularly scattered and may arise from the front of the stems.

One specimen included by von Reuss (viz. *op. cit.* pl. xxx. figs. 8*a*, *b*) is probably a *Homœosolen*, and may be a branch of the same species as the "*Truncatula aculeata*," figured on the same plate (fig. 4); but this cannot be decided without knowledge of the obverse surface of the stem in question.

SEMICYTIS, d'Orbigny, 1854.

[Bry. Crét. p. 1048.]

SYNONYMS.

Osculipora, *pars*, d'Orbigny, 1850.
Desmeopora, *pars*, Bucaille, 1890; Ulrich, 1900.

DIAGNOSIS.

Desmeporidæ with a zoarium fixed by a broad base, supporting a narrow vertical peduncle, which may branch above into a tuft.

The branches may divide dichotomously and may be pinnate. Each branch consists of a round axis, which gives off above a series of pinnules or tufts. These pinnules or tufts may arise independently from the axis or from a ridge running along the obverse surface of the stem.

TYPE SPECIES.

Semicytis rugosa (d'Orbigny), 1850. Senonian: France; Fécamp, Seine-Inferiéure.

AFFINITIES.

D'Orbigny included four species in this genus. His first species and the most suitable type, *S. rugosa*, has the branches divided into a cancellate axis on the reverse side, with a ridge bearing the zoœcial apertures on the obverse. D'Orbigny's *Semicytis fenestrata* and *S. disparilis*, on the other hand, according to the definitions adopted in this Catalogue, are both species of *Homœosolen*. They do not belong to the Cancellata. Their exclusion leaves *Semicytis* as a natural group, which is closely related to *Desmepora*. Bucaille, indeed, reduces *Semicytis* to a mere synonym of *Desmepora*. The two genera may, however, be retained owing to the absence from *Desmepora* of the ridge on the obverse surface. The affinities of the two genera are unquestionably close, and, should they be united, *Desmepora* has priority.

Semicytis rugosa (d'Orbigny), 1850.

SYNONYMY.

Osculipora rugosa, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 268.
Semicytis ,, d'Orbigny, 1854. Bry. Crét. p. 1049, pl. 795, figs. 1–7.
Desmeopora ,, Bucaille, 1890. Bry. Crét. Seine-Inf. : Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 512.

DIAGNOSIS.

Zoarium with a long, narrow, vertical peduncle rising from a group of branches, which are infundibuliform in arrangement, rising from a long cylindrical stem.

Reverse surface covered with pores placed serially between irregularly curved, reticular ribs, of which the longitudinal members of the series are curved.

Lateral processes short and thick, rising from the anterior part of the side of the branches and projecting forward.

Apertures occurring between longitudinal ribs on the reverse surface and extending over the pinnules.

DIMENSIONS.

	B.M. D. 3966.
Diameter of branch	·6–·8 mm.
Diameter of lateral processes	·3–·4 ,,
Length of lateral processes	·5–1 ,,
Average distance of lateral processes	·8 ,,
Diameter of zoœcia	·13–·15 ,,
Diameter of apertures	·08 ,,

DISTRIBUTION.

BRITISH :

Middle Chalk — Zone of *Micraster cortestudinarium* : Chatham ; near Folkestone (*fide* d'Orbigny).

FOREIGN :

Senonian—Coniacian : Fécamp, Seine-Inférieure.
Senonian : Carancy, Pas-de-Calais.

Figures.

Pl. III. Fig. 4. A zoarium, showing the base, peduncle, and obverse surface of a complete branch; × 4 dia. Middle Chalk—zone of *Micraster cortestudinarium*: Chatham. Gamble Coll. **D. 3967.**

Pl. III. Fig. 3. Part of a stem with somewhat irregular pinnules. Fig. 3*a*, obverse face; × 11 dia. Fig. 3*b*, reverse face; × 11 dia. Middle Chalk—zone of *Micraster cortestudinarium*: Chatham. Gamble Coll. **D. 3966.**

LIST OF SPECIMENS.

D. 3966. A branch of a zoarium. Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll. Figd. Pl. III. Figs. 3*a*, *b*.

D. 3967. A zoarium with stem and one complete branch. An isolated fragment of another branch of the same zoarium (in tube). Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll. Figd. Pl. III. Fig. 4.

D. 688. A branch showing reverse face with well-developed pinnules (on slide). Middle Chalk — zone of *Micraster cortestudinarium.* Chatham. Vine Coll. No. 82, 4*g*.

D. 736. Two specimens somewhat resembling the condition of *Desmepora pinnigera*, owing to the more ridge-shaped development of the lateral processes. Middle Chalk — zone of *Micraster cortestudinarium.* Chatham. Vine Coll.

D. 3107. A branch 10 mm. long. Upper Chalk. Loc.? Bowerbank Coll.

D. 3959. *pars.* The second specimen (in tube) with that figured Pl. II. Fig. 7, as *Homœosolen virgulosus*, is a branch of *Semicytis rugosa.* Middle Chalk—zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

ECHINOCAVA, d'Orbigny, 1854.

[Bry. Crét. p. 1012.]

Synonyms.

Ceriopora, pars, Michelin, 1841.
Echinopora, d'Orbigny, 1850 (*non* Lamarck).

Diagnosis.

Desmeporidæ with a massive or branched zoarium. The zoœcia are long and are not arranged in layers. The fasciculi project above the general surface of the zoarium as spines or blunt projections on all sides of the stems.

Type Species.

Echinocava raulini (Michelin), 1841. Albian: Belgium.

AFFINITIES.

This genus was first described as *Echinopora* by d'Orbigny in 1849, and the name, owing to preoccupation, altered to *Echinocava* in 1854. It has hitherto been regarded as a close ally of *Ceriopora*; but an examination of the specimens from Upware, in the Museum of Practical Geology, shows that the spines are projecting fasciculi, and the general surface is not covered by apertures as in a *Ceriopora*, but is cancellate.

Acanthopora, founded for the species *A. spinosa* by d'Orbigny in 1849 as an ally of this genus, is a Hydrozoan.

UNREPRESENTED SPECIES.

1. **raulini** (Michelin), 1841.

SYN. *Ceriopora raulini*, Michelin, 1841. Icon. Zooph. p. 2, pl. i. fig. 7.
,, (*Echinocava*) *raulini*, Etheridge & Newton, 1878. Cat. Cret. Foss. Mus. Pract. Geol. p. 7.
,, ,, ,, Keeping, 1883. Foss. Neoc. Upware, p. 139.
Echinopora raulini, d'Orbigny, 1849. Genr. nouv. Bry.: Rev. Mag. Zool. ser. 2, vol. i. p. 503.
,, ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 141.
Echinocava ,, d'Orbigny, 1854. Bry. Crét. p. 1013, pl. 788, figs. 7, 8.
,, ,, Pergens, 1890. Rev. p. 387.
Semimulticrescis ramosa (?), Etheridge & Newton, 1878. Cat. Cret. Foss. Mus. Pract. Geol. p. 7.

CHAR.—Zoarium arborescent; of long, thin, tapering dichotomous branches, armed with sharp spines, which are irregularly arranged, but usually have four or five in each series around the stem. Apertures small, crowded.

DISTRIB.
British: Lower Greensand: Upware. (Morris Coll. M.P.G., and *fide* Keeping.)
Foreign: Albian: Grandpré and Macheroménil, Ardennes.

2. **salevensis**, de Loriol, 1863.

SYN. *Echinocava salevensis*, de Loriol, 1863. Invert. Néoc. moy. Mt. Salève, pt. ii. p. 144, pl. xviii. fig. 4.

CHAR.—Branches 16 mm. in dia., somewhat compressed. Spines smaller, sharper, and more numerous than in *E. raulini*.

DISTRIB.—Neocomian: La Varappe, Switzerland.

Order TREPOSTOMATA, Ulrich, 1882.

[E. O. Ulrich, American Palæozoic Bryozoa: Journ. Cincinnati Soc. Nat. Hist. vol. v. p. 151.]

DIAGNOSIS.

Bryozoa with a zoarium composed of closely packed zoœcia, which are prismatic or cylindrical and attached to one another throughout their length. The zoarium is massive or consists of thick laminæ. The zoœcia are monomorphic or dimorphic; they begin as simple, thin cyclostomatoid tubes, all of which may develop into zoœcia, or the development of some of them may be arrested, and these form the mesopores. The distal ends of the zoœcia usually have thickened and moniliform walls. The zoœcia and mesopores are usually attached throughout their length, but they may be slightly separated by interzoœcial spaces. Diaphragms generally present. Acanthopores and cystiphragms often present.

AFFINITIES.

The Order Trepostomata is of most importance in the Palæozoic era, and the fossils belonging to it so closely resemble many of the tubular Alcyonarian corals that some Bryozoa may still be included in the Alcyonaria and *vice versa.*

Cainozoic Trepostomata may usually be distinguished from corals by their histological structure; but when this test cannot be applied, owing to the recrystallization of the fossil, it may be doubtful whether a specimen be an Alcyonarian or Bryozoan.

Thus, while many authorities, including Lindström and E. O. Ulrich, refer the Monticuliporidæ to the Bryozoa, Waagen, Wentzel, and Sardeson regard them as Alcyonaria; and Nicholson represents them as a group allied to the Alcyonaria but constituting an independent order. The arguments for their Alcyonarian affinities are clearly stated by Nicholson[1] and Sardeson,[2] and some of the histological evidence seems weighty; but in such old Palæozoic fossils the skeletal material has usually undergone molecular rearrangement, and the radial structure sometimes present is probably due to secondary recrystallization.

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[1] H. A. Nicholson. "On the Structure and Affinities of the genus *Monticulipora* and its subgenera," 1881, pp. 62–78.

[2] F. W. Sardeson. "Ueber die Beziehungen der fossilen Tabulaten zu den Alcyonarien": Neu. Jahrb., Beil.-Bd. vol. x. pp. 347–50.

One useful test for distinguishing coral-like Bryozoa from Bryozoa-like corals is the size of the individual members of the colony. The zoœcia of Bryozoa are much smaller than the corallites of corals. The diameters of the tubes in a number of typical species of Alcyonaria and Trepostomata are stated in the following list:—

Bryozoa.	mm.
Range of diameter in normal species of Cretaceous Trepostomata ...	·05–·4
Leioclema	·2
Homotrypa flabellaris, Ulr. ...	·15–·30
Callopora subnodosa, Ulr. ...	·16–·25
Amplexopora pustulata, Ulr. ...	·16–·25
Homotrypa arbuscula, Ulr. ...	·20–·30
Monticulipora lamellosa, Ulr. ...	·25
,, *winchelli*, Ulr. ...	·17–·28
,, *ulrichi*, Nich. ...	·30
Fistulipora	·30

Alcyonaria.	mm.
Heliolites	1
Propora	1·2
Plasmopora	1–1·5
Polytremacis	1–2
Striatopora	2
Favosites	2
Houghtonia	2–3
Alveolites	3–5
Pleurodictyum ...	4

The diameter of the skeletal tubes in the nine genera of Alcyonaria varies from 1 to 5 mm. The diameter of the skeletal tubes in the fossils in the other list ranges from ·05 to ·4 mm., and thus *Monticulipora* belongs to the small tubed series. There may be exceptions to the rule, for size is rarely an absolute test; but it may be taken as a general rule that the average diameter of the zoœcia of the Trepostomata is about ·2 mm., and that average Alcyonaria are about ten times as large.

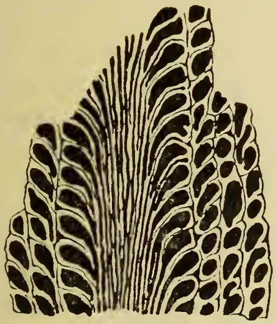

Fig. 30.—*Inversaria tubiporacea* (Goldf.). Longitudinal section; × 8.

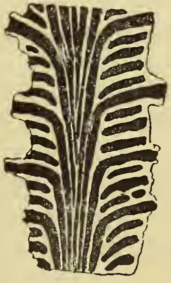

Fig. 31.—*Sparsicavea carantina*, d'Orb. Longitudinal section; × 14.

The two characters used by Ulrich for the foundation of the Trepostomata were (1) that the zoœcia do not enlarge gradually as in the Cyclostomata, and (2) that they bend suddenly outward along part of their course and then change in character. The sudden bend is not confined to the Trepostomata, for we see it in such Cyclostomata as *Inversaria tubiporacea* and *Sparsicavea carantina*, d'Orb., of which illustrations of thin sections, reprinted from Volume I, are shown in Figs. 30 and 31; while in various Trepostomata the zoœcia gradually increase in size without any sudden change in character or direction, as is illustrated by Fig. 32, p. 131, Fig. 42, p. 162, and Fig. 45, p. 166.

In well-preserved Mesozoic Trepostomata, e.g. *Multicrescis tuberosa* (Fig. 54, p. 207), the change in the character of the zoœcia after the distal bend is well marked; the walls become thicker and moniliform, as in the typical Palæozoic forms. The moniliform aspect of the walls is doubtless due to their having been pierced by pores or canaliculi. Slight solution of the walls, such as often occurs during fossilization, would readily convert the canaliculi into funnel-shaped openings separated by bead-like walls.

Nicholson's account of the structure in the recent New Zealand species of *Heteropora* shows that in that species the zoœcia undergo a sudden change at the distal end, that the distal walls are pierced by canaliculi, that the zoœcia have diaphragms or 'tabulæ' and radial spines, and that the large zoœcia are about ·25 mm. in diameter. In all these respects this *Heteropora* agrees with the Monticuliporoids, although all these characters are not present in all the genera of that group and the spines are so delicate that they are rarely preserved.

Nicholson, however, regarded the above characters as merely superficial resemblances, and some of them, such as the presence of the diaphragms, may be explained as independent homoplastic developments; but the value of this group of characters seems to me greater than the differences which led Nicholson to refer *Monticulipora* to the Cœlenterates and *Heteropora* to the Bryozoa. The three differences on which he relied are that *Monticulipora* has imperforate walls, no radiating spines, and a different structure in the different types of 'corallites' in dimorphic or trimorphic species. But these characters are not valid. In regard to the first, Ulrich includes[1] in his diagnosis of the family

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[1] E. O. Ulrich. "Palæontology of Illinois," sect. vi. Palæozoic Bryozoa: Geol. Surv. Illinois, 1890, vol. viii. p. 369.

Monticuliporidæ the statement that the zoœcia have "thin and probably minutely perforated walls, the peculiar granular structure exhibited in thin sections being strongly indicative of an originally porous condition." The absence of radiating spines is not true of all Monticuliporoids, and their presence has only been demonstrated exceptionally among acknowledged Trepostomata. The spines are so delicate that they are easily destroyed and rarely preserved in fossils; even in living species they sometimes escape detection, for their occurrence in the recent *Heteropora* from New Zealand was overlooked by Mr. Waters.[1] The third character —the difference in structure between the larger and smaller individuals in dimorphic colonies—is equally true of the zoœcia and mesopores of dimorphic Trepostomata.

Ulrich, in 1882, included the Cerioporidæ in the Trepostomata; but in 1900[2] he separated them on what seem to me inadequate grounds. He, however, then included in his Cerioporidæ fossils such as *Neuropora*, which I do not regard as a Bryozoan but as a Hydrozoan. The grounds for Ulrich's decision are given in the following quotation: "The Cerioporidæ greatly resemble many of the Palæozoic Trepostomata, but, as a rule, may be readily distinguished by the complete amalgamation and porous nature of their zoœcial walls."

In many Mesozoic Bryozoa here included in the Trepostomata, the walls are as distinct and no more porous than those of some typical Palæozoic members of the group. Ulrich includes the qualification "as a rule," thereby admitting that the grounds of his separation are not constant.

The order Trepostomata appears to be, therefore, Mesozoic as well as Palæozoic. It is well represented in the Jurassic, and some survivors from that fauna and numerous fresh genera lived in the Cretaceous. The Trepostomata are scarcer in the Cainozoic, the group having been dwindling since the Palæozoic, except that they also shared in the great development of tubular Bryozoa that happened in the Cretaceous era.

The Trepostomata comprise many of d'Orbigny's Crescisidæ; but in that family he includes within the genus *Heteropora* many species of *Sparsicavea*, which seem, however, to be Petaloporidæ, as they have maculæ and not mesopores.

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[1] Nicholson, *Monticulipora*, 1881, p. 76.

[2] In Zittel-Eastman. "Textbook of Palæontology," 1900, vol. i. p. 266.

The Cretaceous Bryozoa of this group are easily divisible into those which are monomorphic, of which *Ceriopora* is a convenient type, and those which are dimorphic; the latter include *Heteropora* and its allies, with irregularly arranged zoœcia, and *Radiopora* and its allies, in which the zoœcia are radially arranged.

CERIOPORIDÆ.

SYNONYMY.

Cerioporina, *pars*, von Hagenow, 1851.
Cavidæ, *pars*, d'Orbigny, 1854.
Cerioporidæ, *pars*, Marsson, 1887; *pars*, Ulrich, 1900.
Cerioporidæ, Hennig, 1894.
Frondiporidæ, *pars*, Vine, 1885.
Amplexoporidæ, *pars*, Gregory, 1896.

DIAGNOSIS.

Trepostomata with prismatic or sub-cylindrical zoœcia. No mesopores. Zoœcia thin-walled. Diaphragms absent or present and sometimes numerous. Zoarium typically massive, but it may be composed of thick branches. (Age, Mesozoic and Cainozoic.)

AFFINITIES.

In the Catalogue of the Jurassic Bryozoa (p. 195) a series of species of *Ceriopora* was included in the Palæozoic family the Amplexoporidæ, owing to the absence of any definite character, except age, to separate them from that family. I am still unable to point to any definite separation between the Amplexoporids of the Lower and Middle Palæozoic and the Mesozoic Cerioporids; but the two groups are widely separated in time, and I cannot see any evidence to show that various Jurassic and Cretaceous Cerioporids have descended from different Palæozoic Amplexoporids. The probabilities seem to be that all the Jurassic and Cretaceous Cerioporids are the offspring of a small Triassic fauna, which was probably monogenetic from either a Triassic or Upper Palæozoic ancestor. Hence it seems most convenient and natural to separate the Mesozoic and Palæozoic forms into distinct families.

Of the names available for the family, d'Orbigny's Cavidæ would be better retained, if retained at all, for *Ceriocava* (of which

Cava is a synonym) or *Sulcocava.* The name *Cerioporina* was proposed by von Hagenow for a group and not a family, and he did not in his monograph attempt to define families. The family Cerioporidea proposed by Marsson in 1887 appears to be the most convenient for this series of genera.

The number of genera to be included in this family is uncertain. It includes several of d'Orbigny's family, the Cavidæ, exclusive, however, of *Cava* and *Sulcocava* and their allies. The second species which d'Orbigny included in *Cava* (viz. *C. subcompressa*) is, however, a *Ceriopora* (B.M. Cat. Jur. Bry. p. 200). The true *Ceriocava,* which includes the type species of *Cava* and its young stage *Reptonodicava,* should be excluded, the typical species of that genus being Entalophorids with trumpet-shaped zoœcia.[1] The Cretaceous *Ceriocavæ* of d'Orbigny are branched species of *Ceriopora*; but the difference between the thick branches of this genus and the tuberous processes and finger-shaped forms of the massive species does not seem of generic value.

The series of Cretaceous Cerioporids may be grouped as follows:—

Reptomulticava.—Zoœcia short and zoarium multilamellar. The genus corresponds to *Reptomultisparsa* in the *Berenicea* series.

Defranciopora.—Zoarium of several superposed, saucer-shaped sub-colonies.

Ceriopora.—Zoarium massive or branched, with long zoœcia.

REPTOMULTICAVA, d'Orbigny, 1854.

[Bry. Crét. p. 1032.]

SYNONYMS.

Alveolites, *pars*, Römer, 1839.
Millepora, *pars*, Römer, 1839.
Ceriopora, *pars*, Goldfuss, 1827; de Blainville, 1834; von Hagenow, 1851; Winkler, 1864; von Reuss, 1846 and 1872; Hamm, 1881; Hennig, 1894, etc.
Chætetes, *pars*, von Reuss, 1846; Michelin, 1847.
Monticulipora, *pars*, d'Orbigny, 1850.
Polytrema, *pars*, d'Orbigny, 1850.
Radiopora, *pars*, d'Orbigny, 1854; Pergens, 1890.
Semimulticava, *pars*, d'Orbigny, 1854.
Semicava, d'Orbigny, 1854.
Reptocea, Keeping, 1883.
? *Domopora*, *pars*, Hamm, 1881.

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[1] See B.M. Cat. Jur. Bryozoa, pp. 164, 165, figs. 13, 14.

DIAGNOSIS.

Cerioporidæ with a massive or branched zoarium, composed of many layers. The zoœcia are short and expand rapidly. Surface of zoarium not raised in spines, but may have tuberous processes.

TYPE SPECIES.

Reptomulticava heteropora (Römer), 1839. Neocomian : France and Germany. This species is more convenient than *R. micropora* as the type, owing to the possibility of confusion between *Reptomulticava micropora* and *Ceriopora micropora*.

AFFINITIES.

The zoœcia in this genus differ from those of its ally *Ceriopora* by being shorter and arranged in thin superposed layers. This lamellar structure is shown in Fig. 35, p. 133, Fig. 36, p. 134, Fig. 39, p. 136, and Fig. 40, p. 140; these figures may be contrasted with the section of *Ceriopora* shown in Fig. 43, p. 165. The difference seems fully of generic value. It is true that a certain degree of lamination occurs in a true *Ceriopora*; for as a colony of that genus grows upward and outward, the margin of the expanding zoarium spreads beyond the earlier part, and thus, when seen from the side, the mass may appear somewhat banded. The multilamellar structure of *Reptomulticava*, however, is developed throughout the whole zoarium, and not only on the growing margin.

The separation of *Reptomulticava* and *Ceriopora* is convenient, as it avoids the disturbance of specific names, where, as in the case of *micropora*, the same name has been used in both genera.

1. **Reptomulticava canui**, Gregory, 1909.

SYNONYMY.

non Alveolites tuberosa, Römer, 1839. Verst. nordd. Ool.: Nachtrag, p. 14, pl. xvii. fig. 9.
non Ceriopora (*Alveolites*) *tuberosa*, Römer, 1840. Verst. nordd. Kr. p. 23.
non ,, *tuberosa*, Michelin, 1846. Icon. Zooph. p. 208, pl. liii. fig. 1.
non ,, ,, Kade, 1852. Los. Verst. Schanzenb. p. 32.
Polytrema tuberosa, *pars*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 94.
Reptomulticava tuberosa, d'Orbigny, 1854. Bry. Crét. p. 1036, pl. 791, figs. 13, 14.
,, ,, Pergens, 1890. Rev. p. 387.
,, ,, Canu, 1902. Bry. foss. i., Coll. Camp.: Bull. Soc. géol. Fr. ser. 4, vol. ii. p. 12.
,, *canui*, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. 5, vol. vi. p. 63.

Diagnosis.

Zoarium massive, tuberous, with small irregular tuberosities on the upper surface.

Zoœcia with circular or elliptical apertures, and walls varying in width from one-fifth to occasionally one-half the diameter of the apertures.

Dimensions.

	Specimen figured by d'Orbigny.
Diameter of zoarium	36 mm.

Distribution.

Neocomian: St. Dizier and Vassy, Haute Marne.

Affinities.

The characters shown by Römer's original figure suggest doubts whether this form is a Bryozoan, as the apertures are represented as angular; but a specimen from Berklingen, **D. 3647** in the Museum collection, that appears to be the same as Römer's *Alveolites tuberosa*,[1] has the apertures small and round.

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[1] The specific name *tuberosa* has been used for several species which have been somewhat confused. Their relations may be explained by the following table:—

Original Name.			Horizon.	Name adopted.
Alveolites	*tuberosa*,	Röm., 1839	Neoc. Germany	*Ceriopora tuberosa* (Röm.), p. 165
,,	,,	d'Orb., 1854	Neoc. France	*Reptomulticava canui*, Greg., p. 128
Ceriopora	,,	Hagenow, 1840	Sen. Rügen	*Canalipora constricta* (Röm.), p. 176
,,	,,	Michelin, 1846	Cenom. Le Mans	*R. pseudotuberosa* (d'Orb.), p. 151
Heteropora	,,	Röm., 1839–40	Neoc. Germany	*Multicrescis tuberosa* (Röm.), p. 205
Alveolites	*heteropora*,	Röm., 1839	Neoc. Germany	*Reptomulticava heteropora* (Röm.), p. 132

The *Radiopora heteropora*, d'Orb., is the *R. neocomiensis* (d'Orb.), 1850. *Heteropora tuberosa*, Röm., 1840 (*non* 1839), was erroneously placed by d'Orbigny in the species here accepted as *Radiopora neocomiensis* (d'Orb.), 1850.

Accordingly it is necessary to separate the French Neocomian fossils, identified as *R. tuberosa* by d'Orbigny in 1854 and by Canu in 1902, from that species; and as a new name is required for the French form, it may be conveniently named after M. Canu.

R. canui differs from *Ceriopora tuberosa* (Röm.), as the zoarium is tuberous and not dendroid, while the zooecia are circular instead of angular in section. As d'Orbigny assigned his species to the genus *Reptomulticava*, its structure is doubtless multilamellar, though this character is suggested rather than distinctly shown in his figure (Bry. Crét. pl. 791, fig. 11). The specimen figured by d'Orbigny, according to M. Pergens, is lost; accordingly the Museum specimen, **D. 7077**, had better be regarded as the type.

D. 7077. The type-specimen. Neocomian. Goslar, Hanover. Purchased of Dr. F. Krantz, June, 1898.

2. Reptomulticava micropora[1] (Römer), 1839.

SYNONYMY.

Alveolites micropora, Römer, 1839. Verst. nordd. Ool.: Nachtrag, p. 14, pl. xvii. fig. 11.
Reptomulticava micropora, d'Orbigny, 1854. Bry. Crét. p. 1035, pl. 791, figs. 10–12.
,, ,, de Loriol, 1863. Foss. Néoc. moy. Mt. Salève, pt. ii. p. 145, pl. xix. fig. 2.
,, ,, de Loriol, 1868. Valang. Arzier: Mat. Pal. Suisse, ser. 4, pt. ii. p. 67, pl. vi. figs. 7–9.
Radiopora heteropora, *pars*, Pergens, 1890. Rev. p. 387.
? *Ceriopora micropora*, Dubois de Montpéreux, 1836. Géol. Cauc. et Crimée: Bull. Soc. géol. Fr. vol. viii. opp. p. 385.
? ,, ,, de Verneuil, 1838. Géol. Crimée: Mém. Soc. géol. Fr. vol. iii. p. 21.
,, ,, Baily, 1858. Invert. Crimea: Quart. Journ. Geol. Soc. vol. xiv. p. 155.

DISTRIBUTION.

Valangian: Arzier.
Neocomian: Sainte-Croix; La Varappe and Grande-Gorge, Mont Salève, Switzerland; Berklingen, Schandelahe, and Goslar, Germany; St. Dizier, Haute-Marne, France; [2] ? Baktchserai, Crimea.

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[1] This species is quite distinct from the *Ceriopora micropora* of Goldfuss, 1827, for which see p. 158.

[2] Possibly the records of *Ceriopora micropora* from the Neocomian of the Crimea, by Dubois de Montpéreux, de Verneuil, and Baily, are based on this species.

Diagnosis.

Zoarium massive, irregularly ovoid, with smooth surface, except where broken by the edges of the zoœcial layers.

Zoœcia with walls thin; apertures, according to de Loriol, about twenty-five per square mm., and subcircular or elliptical, and irregular in size.

Dimensions.

	Goslar. B.M. D. 7078.	D'Orbigny's specimen.	De Loriol, 1868.
	mm.	mm.	mm.
Diameter of zoarium	—	42 × 25	11 × 10–41 × 25
Diameter of aperture	·1	—	about ·3
Distance of zoœcial centres ...	·2–·3	—	,, ·5
Number of apertures per sq. mm.	about 13	—	25

Figures.

Pl. IX. Fig. 3. Part of the surface of a zoarium; × 10 dia. Neocomian: Berklingen. **D. 3645.**

Fig. 32. Part of vertical section through part of the upper surface of a zoarium; × 8 dia. Neocomian: Goslar. Krantz Coll. **D. 7078.**

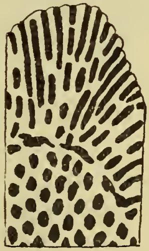

Fig. 32.—*Reptomulticava micropora*; × 8. **D. 7078.**

Affinities.

Pergens' suggestion that this species is a synonym of *Radiopora heteropora* is inconsistent with the descriptions and figures of both de Loriol and d'Orbigny.

LIST OF SPECIMENS.

D. 7078. Four specimens and a slide, with vertical section cut from one. Neocomian. Goslar, Harz. Purchased F. Krantz. Fig. 32.

D. 3646. Two zoaria: one is a flat nodule 14 × 13 mm. in diameter and 7 mm. thick. The second is 10 × 7 mm. in diameter and 15 mm. thick. The apertures are very irregular in size. Neocomian—Hilsconglomerat. Berklingen. Saemann Coll. The original label with the specimens identifies them as *Alveolites micropora.*

D. 3645. A nodular zoarium 13 × 8 × 10 mm. in diameter. The apertures are ·2 mm. in diameter and sub-pentagonal in shape. They have probably been increased in apparent size and angularity as the ends have been worn down. Neocomian — Hilsconglomerat. Berklingen. Saemann Coll. Figd. Pl. IX. Fig. 3.

3. **Reptomulticava heteropora** (Römer), 1839.

SYNONYMY.

Alveolites heteropora, Römer, 1839. Verst. nordd. Ool.: Nachtrag, p. 14, pl. xvii. figs. 7, 8.
non Radiopora ,, *pars,*[1] d'Orbigny, 1854. Bry. Crét. p. 993, pl. 781, figs. 13–16.
,, ,, ,, Canu, 1902. Bry. foss. i., Coll. Camp.: Bull. Soc. géol. Fr. ser. 4, vol. ii. p. 12.
Lichenopora (*Radiopora*) *heteropora, pars,* Pergens, 1890. Rev. p. 383.
non Heteropora tuberosa, Römer, 1840. Verst. nordd. Kr. p. 23.
,, *Polytrema subtuberosa,* d'Orbigny, 1850. Prod. Pal. vol. ii. p. 94.

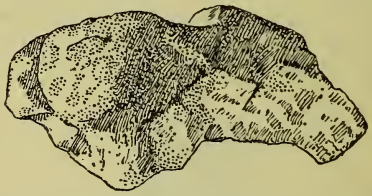

FIG. 33.—*Reptomulticava heteropora*; × $1\frac{1}{3}$. **D. 3653.**

DIAGNOSIS.

Zoarium nodular, massive; often with a pitted surface. The zoarium may (*fide* Römer's figure No. 7) begin as a disc attached to a foreign body. In adult zoaria the surface is irregular and hummocky.

The zoarium is composed of layers usually about 1 mm. thick.

Apertures circular, crowded, about ·1–·2 mm. in dia. They are often in lines, and in places the arrangement of the apertures is regular (cf. Fig. 34).

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[1] The two references included by d'Orbigny in 1854, which I refer to *Reptomulticava heteropora,* are those of Römer, '1836,' and the *Polytrema subtuberosa,* d'Orb., 1854, but *non* d'Orb., 1850.

DIMENSIONS.

	Römer's type. mm.		B.M. D. 3653. mm.
Length of zoarium...	23	..	36
Height of zoarium...	13	...	17
Thickness of zoœcial layers	—	...	1
Diameter of apertures	—	..	·15
Average width of walls between apertures	—	...	·08–·15

DISTRIBUTION.

Neocomian—Hilsconglomerat: Berklingen, Schöppenstedt, and Schandelahe, Brunswick.

FIGURES.

Fig. 33, p. 132. A zoarium from the side; × 1⅓ dia. Neocomian: Berklingen. **D. 3653.**

Fig. 34. Part of the surface of the zoarium; × 13⅓ dia. Neocomian: Berklingen. **D. 3653.**

Fig. 35. Part of a section; × 10 dia. Neocomian: Berklingen. **D. 3653.**

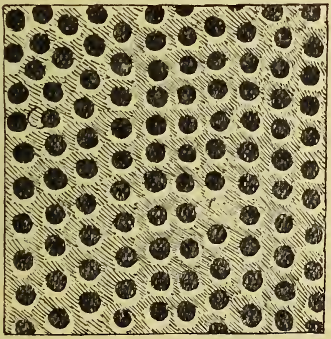

FIG. 34.—*Reptomulticava heteropora*; × 13⅓. **D. 3653.**

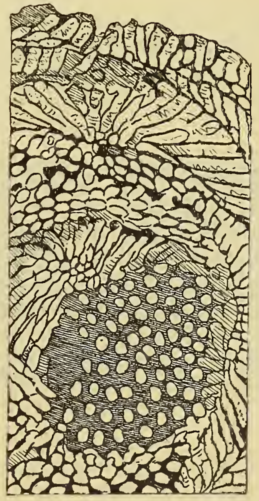

FIG. 35.—*Reptomulticava heteropora*; × 10. **D. 3653.**

AFFINITIES.

The name of this species suggests that the zoœcia are dimorphic, in which case it could not be a *Reptomulticava*, but one of the Heteroporidæ. Römer's figure, however, gives no evidence that the structure is dimorphic, and the Museum specimens (**D. 3653**) are certainly *Reptomulticava.* The specimens included in this species by d'Orbigny are here referred to *Radiopora* (p. 284).

It is doubtful whether the young specimen attached to a Brachiopod, and figured by Römer as his figs. 7*a*, *b*, belongs to this species.

D. 3653. Two zoaria and sections cut from them. Neocomian — Hilsconglomerat. Berklingen. L. Saemann Coll. Figs. 33–5, pp. 132, 133. The specimens are accompanied by a Saemann label, on which they are identified as "*Alveolites heteropora*"; they have the pitted surface which is a characteristic feature of Römer's figure. The zoœcia, however, as shown in Fig. 34, are monomorphic, and the structure, as shown by Fig. 35, is multilamellar.

4. **Reptomulticava lobosa** (Keeping), 1883.

SYNONYMY.

Reptocea lobosa, Keeping, 1883. Foss. Neoc. Upware, p. 141, pl. vii. fig. 15.

DIAGNOSIS.

Zoarium massive, rising above into club-shaped lobes, which give the zoarium a somewhat botryoidal aspect.

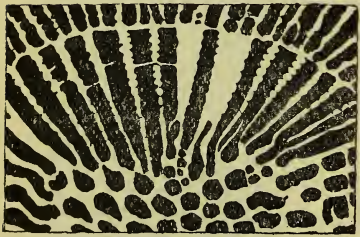

FIG. 36.—*Reptomulticava lobosa*; × 13. **D. 7295**

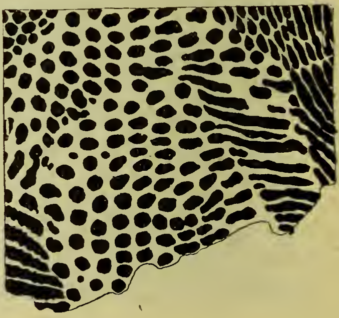

FIG. 37.—*Reptomulticava lobosa*; × 11½. **D. 7295.**

Zoœcia short, and expanding till they are about ·25 mm. across. Diaphragms scanty. Zoœcia occur in thick layers, and are arranged in circular groups.

Apertures often quincuncial in arrangement; they are circular to trigonal in shape.

DIMENSIONS.

	Keeping's type. mm.		B.M. D. 7295. mm.
Height of zoarium	20	...	—
Width of zoarium	24	...	—
Diameter of lobe	6–8	...	—
Diameter of zoœcia	—	...	·3
Length of zoœcia	—	...	1·5

DISTRIBUTION.

Lower Greensand: Brickhill, Upware.

FIGURES.

Fig. 36, p. 134. A vertical section across part of a zoarium; × 13 dia. **D. 7295.**

Fig. 37, p. 134. A horizontal section across part of the same specimen; × 11½ dia. **D. 7295.**

LIST OF SPECIMENS.

D. 7295. A massive zoarium with three slides cut from it. Lower Greensand. Upware, Cambridge. Presented by the late J. F. Walker, 1868. Figs. 36, 37, p. 134.

46,749. Lower Greensand. Upware. Presented by the late J. F. Walker, 1868.

D. 3124. Lower Greensand. Upware. Old Coll.

5. **Reptomulticava fungiformis,** Gregory, 1909.

SYNONYMY.

Ceriopora avellana, *pars*, Etheridge & Newton, 1878. Cat. Cret. Foss. Mus. Pract. Geol. p. 6.

? ,, ,, (*non* Michelin), Vine, 1891. Rep. Cret. Polyz.: Rep. Brit. Assoc. 1890, p. 384.

Reptomulticava fungiformis, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. 5. vol. vi. p. 63.

DIAGNOSIS.

Zoarium fungiform with broad, short stalk, which may be hidden by the overgrowth of the broad upper surface of the zoarium. The side looks ringed by the overlap of the expanding upper layer.

Zoœcia small; the apertures in well-preserved specimens are circular. Twelve to forty apertures per sq. mm.

DIMENSIONS.

		D. 3014. mm.	10,301. mm.
Zoarium :	diameter of head	18	18 × 14
,,	diameter of stalk	10	12
,,	length of stalk	8	5
,,	height of	16	14
,,	diameter of aperture	·2	—
,,	number of apertures per sq. mm.	12	36

FIGURES.

Pl. VII. Fig. 6*a*. A zoarium from the side; nat. size. Fig. 6*b*, part of the surface of the same specimen; × 10 dia. Lower Greensand: Farringdon. Caleb Evans Coll. **D. 3014.**

Fig. 38. Transverse section across a zoarium; × 6 dia. Lower Greensand: Farringdon. Cunnington Coll. **D. 5042.**

Fig. 39. Vertical section across the same zoarium; × 6 dia. **D. 5042.**

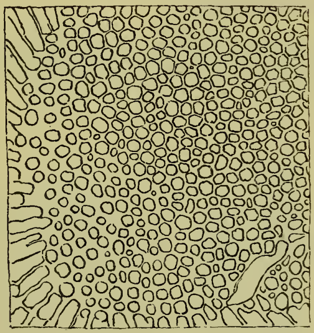

FIG. 38.—*Reptomulticava fungiformis*; × 6? **D. 5042.**

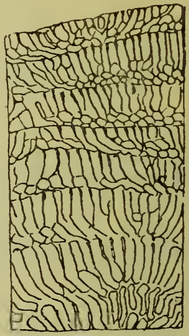

FIG. 39.—*Reptomulticava fungiformis*; × 6? **D. 5042.**

DISTRIBUTION.

Lower Greensand—Aptian: Farringdon; Badbury Hill; Upware.

AFFINITIES.

The nearest ally of this species is *R. gillieroni*, Lor., which differs from it by having much smaller zooecia and having from 80 to 100 apertures per sq. mm. It is also allied to *Reptomulticava avellana* (Mich.), and the record of that species at Farringdon is partly based on it. Of the four specimens thus identified in the

Museum of Practical Geology, one is a *Heteropora*; of the three remaining specimens, one is probably from Upware and the other two from Farringdon. *R. avellana* differs from *R. fungiformis* by the absence of the ringed peduncle and the smaller size of the apertures.

LIST OF SPECIMENS.

D. 3014. The type-specimen, a broad-based zoarium. Lower Greensand. Farringdon. Caleb Evans Coll. Purchased from E. Westlake. Figd. Pl. VII. Fig. 6.

D. 5042. A zoarium cut vertically and horizontally, and two slides, one cut in each direction. Lower Greensand. Farringdon, Berks. Cunnington Coll. Section. Figs. 38, 39, p. 136.

10,302. A zoarium cut into pieces and slide with transverse section. Lower Greensand. Farringdon. Mantell Coll.

D. 3013. A depressed hollow zoarium, 21 × 28 mm. in dia. and 14 mm. high. Lower Greensand. Workhouse Pit, Farringdon. Caleb Evans Coll. Purchased from E. Westlake.

D. 3010. A small flat-based zoarium. Lower Greensand. Badbury Hill, Farringdon. Caleb Evans Coll. Purchased from E. Westlake.

D. 3015. A tuberous zoarium. Lower Greensand. Farringdon. Caleb Evans Coll. Purchased from E. Westlake.

10,305. An irregular zoarium with a tendency to an ovoid form. Part of the surface shows the closure of some of the apertures by a secondary calcareous layer. Lower Greensand. Farringdon. Mantell Coll.

10,301. A zoarium, 18 mm. in dia. and 14 mm. high, with thirty-six apertures per square mm. Lower Greensand. Farringdon. Mantell Coll.

D. 5041. Three zoaria; the best preserved is 18 mm. in dia. and 15 mm. high. Two of them are covered by a secondary crust and are not certainly determinable. Lower Greensand. Farringdon. Cunnington Coll.

6. **Reptomulticava avellana** (Michelin), 1846.

SYNONYMY.

Ceriopora avellana, Michelin, 1846. Icon. Zooph. p. 208, pl. lii. fig. 13.
,, ,, von Reuss, 1872. Bry. unt. Quad.: Palæontogr. vol. xx. pt. i. p. 128, pl. xxxi. figs. 8, 9.
non ,, ,, Etheridge & Newton, 1878. Cat. Cret. Foss. Mus. Pract. Geol. p. 6.
Reptomulticava avellana, d'Orbigny, 1854. Bry. Crét. p. 1034.
Chætites cretosus, von Reuss, 1846. Verst. böhm. Kr. p. 63, pl. xliii. fig. 4.
Ceriopora micropora, *pars*, Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 210.

? *Ceriopora micropora*, Fric, 1869. Pal. Stud. böhm. Kr.: Arch. naturw. Landesf. Böhm. vol. i. pt. ii. p. 222.
,, ,, Simonowitsch, 1871. Bry. Ess. Grüns.: Verh. nat. Ver. preuss. Rheinl. vol. xxviii. p. 50.
,, ,, von Reuss, 1872. *Op. cit.* p. 127, pl. xxxi. figs. 6, 7.
,, *phymatodes*, von Reuss, 1872. *Ibid.* p. 128, pl. xxxi. figs. 10, 11.

DIAGNOSIS.

Zoarium nodular; it begins as an irregular spheroid, from 7 or 8 mm. in diameter, with a smooth surface; but it grows to 25 mm. in diameter, and the surface is raised in blunt processes, which may render the zoarium botryoidal. Apertures crowded, and often subangular and minute.

DISTRIBUTION.

BRITISH:
? Albian—Zone of *Schlœnbachia rostrata*: Haldon Hills, near Exeter.

FOREIGN:
Cenomanian: Le Mans.
Unter Quader: Plauen, Saxony.
Korycaner Schichten: Schillinge, near Bilin; Korycany, Bohemia.

AFFINITIES.

This species is a member of the *fungiformis-micropora* series. It differs from *R. fungiformis* by the absence of the ringed stalk. Von Reuss refers to the lamellar structure of this species.

Von Reuss, in 1872, figured and described two specimens from Plauen as *Ceriopora avellana*; he refers to their having much smaller pores than *C. micropora*, and says the pores are not visible to the naked eye. At the same time he figured two globular specimens, 8 to 9 mm. in diameter, as *C. micropora*; they do not, however, belong to that species, but apparently to his *C. avellana*. So far as von Reuss's figures allow an estimate of their size, the apertures seem to have the average diameter of those in the latter species.

The inclusion of *C. phymatodes* in this species seems inevitable, in spite of the fact that, at first sight, the apertures in *C. phymatodes* appear larger; certainly, if von Reuss were right in his identification of the specimens which he figured as *C. avellana*, his *C. phymatodes* should be merged in that species. Michelin's type-specimen of *C. avellana* is a small, smooth, spheroidal mass, like von Reuss's specimens of *C. micropora*. Von Reuss referred to *C. avellana* some humped zoaria which resemble his *C. phymatodes* more than Michelin's type of *avellana*. The evidence for the inclusion in *Reptomulticava avellana* of the Plauen specimens that have been assigned to *C. micropora* is referred to on p. 160.

This species is doubtfully represented in the collection by the following specimen:—

D. 7398. A nodular zoarium, 58 mm. in dia. and 35 mm. high. Albian—zone of *Schlœnbachia rostrata*. Haldon Hills, south-west of Exeter. Vicary Coll. Bequeathed 1903. The zoœcia are arranged radially; the structure in sections is somewhat like a coral. It is too worn for certain determination. The specimen is a siliceous pseudomorph, and most of the surface is corroded and covered by beekite; the apertures, as far as visible, resemble those of *Ceriopora*. The zoœcia, however, are in long radial series, and there is no clear proof of lamellar structure; there are apparent concentric layers like the platforms of a *Tubipora*, but the zoœcial walls traverse the layers uninterruptedly, so that the specimen may belong to *Ceriopora*.

7. Reptomulticava substellata (d'Orbigny), 1850.

SYNONYMY.

Ceriopora stellata, *pars*, Goldfuss, 1829. Petref. Germ. p. 85, pl. xxxi. figs. 1*a*, *b* (*non c*).
Radiopora substellata, *pars*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 176.
,, ,, ,, d'Orbigny, 1854. Bry. Crét. p. 993.
,, ,, Simonowitsch, 1871. Bry. Ess. Grüns.: Verh. nat. Ver. preuss. Rheinl. vol. xxviii. p. 46, pl. ii. figs. 4*a–d*.
Ceriopora ,, von Reuss, 1872. Bry. unt. Quad.: Palæontogr. vol. xx. pt. i. p. 125, pl. xxx. figs. 9, 10, 11, ?12; pl. xxxi. figs. 1–3.
,, ,, *pars*, von Reuss, 1874. Bry. ob. Plän.: *ibid.* vol. xx. pt. ii. p. 136.
?*Heteropora* ,, Pergens & Meunier, 1887. Bry. gar. Faxe: Ann. Soc. malac. Belg. vol. xxi., Mém. p. 224.

DIAGNOSIS.

Zoarium very variable. The typical form is massive and nodular, with many raised lobes and circular groups of Cerioporoid zoœcia. In other forms the zoarium begins as a simple mamelon, composed of several layers, and growing into a cylindrical stem, with crowded, sub-quincuncial apertures; the stem may be laterally constricted, and terminate above in lobes which are lamellar and therefore Reptomulticavan in structure.

The apertures are not radial in arrangement.

DIMENSIONS.

	Von Reuss, *op. cit.* 1872.				B.M. D. 3669.
	Pl. XXX. Fig. 10.	Pl. XXX. Fig. 9.	Pl. XXXI. Fig. 3.	Pl. XXXI. Fig. 1.	
	mm.	mm.	mm.	mm.	mm.
Height of zoarium	6	6	8	4	8
Diameter of stems	4	5	4	4	4–6
Zoœcia: diameter of apertures ...	? ·06	·1–·2	—	·1	·1

DISTRIBUTION.

? Danian: Faxoe (*fide* Pergens & Meunier).
Turonian—Upper Pläner: Strehlen, Saxony (*fide* von Reuss).
Cenomanian—Grünsand: Essen.
Korycaner Schichten: Zalabi and Schillinge, near Bilin, Bohemia.
Lower Pläner: Plauen, Saxony.

FIGURES.

Fig. 40. Part of a vertical section; × 4½ dia. Cenomanian: Essen. Bruckmann Coll. **D. 3669.**

Fig. 41. Part of a vertical section; × 15 dia. Cenomanian: Essen. Bruckmann Coll. **D. 3618.**

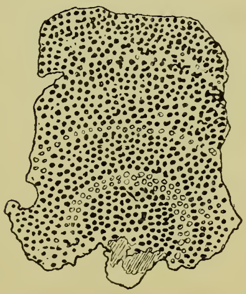

FIG. 40.—*Reptomulticava substellata*; × 4½. **D. 3669.**

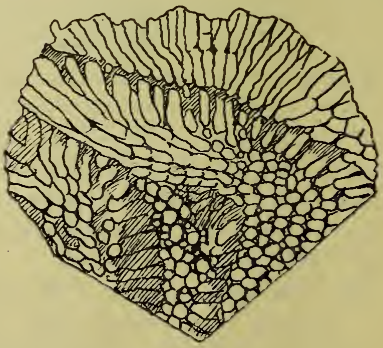

FIG. 41.—*Reptomulticava substellata*; × 15. **D. 3618.**

AFFINITIES.

The range of this species is doubtful owing to the action of von Reuss in 1874 (*op. cit.* p. 136). He then included in it the species founded by himself twenty-eight years earlier as

C. mammilla, which is here regarded as probably a species of *Canalipora* (*vide* p. 177). Meanwhile d'Orbigny had included in *C. mammilla* a group of Senonian specimens, and subsequently Keeping extended its range to the Aptian. Both the last decisions are doubtful, and d'Orbigny's specimens are in any case distinct from *R. substellata.* Pergens & Meunier record it from the Danian of Faxoe, and say that their specimens agree with the form shown by von Reuss in his pl. xxx. fig. 12. Unless this record be correct, the species is mainly Cenomanian, but ranging up into the Turonian.

This species was founded on one of the specimens figured by Goldfuss as *C. stellata.* This specimen (Petref. Germ. pl. xxx. figs. 1*a*, *b*, *non* fig. *c*) was apparently intended by d'Orbigny for his species *substellata*, and was definitely selected as the type by von Reuss in 1872. The zoarium in the type-specimen is massive and tubercular.

The *substellata* form has certainly some zoarial resemblances to *Radiopora*, but the apertures lack the essential character, for they are not radially arranged.

Simonowitsch remarks (Bry. Ess. Grünsd. p. 47) that the arrangements of the apertures "ergibt sich gar keine Regel; sie treten gemischt auf." And their crowded, irregular arrangement is shown in his figures. The two specimens **D. 3617** and **D. 3622** in the Museum Collection each show in one place a faint linear arrangement of the apertures; but this is probably only accidental, and the species must be left in *Reptomulticava.*

LIST OF SPECIMENS.

D. 3618. A zoarium which is in part a thin incrustation and partly a massive nodule 8 mm. thick. The surface of the incrusting part is marked by pustules 2 mm. thick. Essener Grünsand. Essen. Bruckmann Coll. Fig. 41, p. 140.

D. 3617. Two pustular zoaria, which have grown as incrustations; one is a hollow nodule, having apparently grown over some soft-bodied organism. The apertures in one specimen occur in short series, with four apertures in a series. Essener Grünsand. Essen. Bruckmann Coll.

D. 3622. A zoarium which begins as a flat incrustation; but one stem has free branches 4–5 mm. high, and thus approaches the form of *Radiopora stellata*; the occurrence of some apertures in linear series is faintly indicated. Essener Grünsand. Essen. Bruckmann Coll.

D. 3669. A thin vertical section (on slide). Essener Grünsand. Essen. Bruckmann Coll. Fig. 40, p. 140.

8. **Reptomulticava spongites** (Goldfuss), 1827.

SYNONYMY.

Ceriopora spongites, Goldfuss, 1827. Petref. Germ. p. 35, pl. x. fig. 14.
,, ,, Römer, 1840. Verst. nordd. Kr. p. 22.
,, ,, von Reuss, 1846. Verst. böhm. Kr. p. 63, pl. xiv. fig. 13.
[1] ? ,, ,, Wiltshire, 1859. Red Chalk: Geol. p. 276.
[1] ? ,, ,, Seeley, 1861. Posit. Red Limestone: Ann. Mag. Nat. Hist. ser. 3, vol. vii. p. 243.
,, ,, Frič, 1869. Pal. Unt. böhm. Kr.: Arch. naturw. Landesf. Böhm. vol. i. pt. ii. p. 206.
,, ,, von Reuss, 1872. Bry. unt. Quad.: Palæontogr. vol. xx. pt. i. p. 126, pl. xxxi. figs. 4, 5.
Polytrema ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 183.
Reptomulticava ,, d'Orbigny, 1854. Bry. Crét. p. 1037.
,, ,, Simonowitsch, 1871. Bry. Essen.: Verh. nat. Ver. preuss. Rheinl. vol. xxviii. p. 52, pl. iii. figs. 1*a–f*.
,, ,, Pergens, 1890. Rev. p. 387.
,, *cupula*, d'Orbigny, 1853. Bry. Crét. pl. 792, figs. 6–11.

DIAGNOSIS.

Zoarium sub-pedunculate, with step-like, lateral expansions and an epizoarial layer on the under side; upper surface typically flat or concave, but rising into a blunt point in the Bohemian variety.

Apertures circular; zoœcial walls thin. Zoœcia large.

The specimen figured by von Reuss (1872) is a flat, thin, adnate disc, obviously a young individual. Those figured by Simonowitsch are young pedunculate forms.

DIMENSIONS.

	Figured by von Reuss, 1872.	B.M. D. 3626.
	mm.	mm.
Height of zoarium	6	6
Diameter of head	—	8 × 6
Diameter of base	—	4 × 4
Diameter of apertures	·3	·5

DISTRIBUTION.

Cenomanian: Essen; Le Mans, Sarthe; Rennes, Aude.
Lower Quader: Plauen, Saxony; Schillinge, near Bilin, Bohemia.
Korycaner Schichten: Kamajka and Zbislaw, Bohemia.

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[1] The specimens thus recorded by Wiltshire and Seeley are probably *Zonatula favus* (Seeley), *vide postea*, p. 216.

LIST OF SPECIMENS.

D. 3626. Four zoaria (in tube). Dimensions quoted above. Essener Grünsand. Essen. Saemann Coll.

D. 3625. One zoarium (on slide). Essener Grünsand. Essen. Old Coll.

9. **Reptomulticava polytaxis** (von Hagenow), 1851.

SYNONYMY.

Ceriopora	*polytaxis*,	von Hagenow, 1851. Bry. maastr. Kr. p. 51, pl. v. fig. 2.
,,	,,	Kade, 1852. Los. Verst. Schanzenb. p. 32.
,,	,,	Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 36.
,,	,,	Canu, 1900. Bry. Tours : C.R. Assoc. franç. Av. Sci. 1899, p. 410.
Reptomulticava	,,	d'Orbigny, 1854. Bry. Crét. p. 1034.
,,	,,	Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 225.
Heteropora	,,	*pars*, Pergens & Meunier, 1887. Bry. gar. Faxe : Ann. Soc. malac. Belg. vol. xxi., Mém. p. 223.
,,	,,	Pergens, 1888. Tuf. Ciply : Bull. Soc. belge Géol. vol. i. p. 205.
non Domopora	,, ?,[1]	Vine, 1885. Camb. Greensd. : Proc. Yorks. Geol. Soc. new ser. vol. ix. p. 21.
,, ,,	,, ?,	Vine, 1889. Further on Camb. Greensd. : *ibid.* vol. xi. pp. 258, 270.
,, ,,	,, ?,	Vine, 1891. Rep. Cret. Polyz. : Rep. Brit. Assoc. 1890, p. 389.

DIAGNOSIS.

Zoarium variable. It begins as a small, flat incrustation, and usually grows erect into a thick stem, which may divide above into two or more lobes or branches; or the zoarium may remain nodular with an irregular hummocky upper surface.

DIMENSIONS.

	Von Hagenow's type.	D. 3604.	D. 3361.
	mm.	mm.	mm.
Height of zoarium	9	6	30
Diameter of zoarium	6	5 × 3	10 × 8
Diameter of apertures	·06	—	—

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[1] See *Tholopora vinei*, Gregory, *vide postea*, p. 276.

DISTRIBUTION.

Danian: Faxoe, Ciply (Tuffeau de Ciply; *fide* Pergens).
Senonian—Maastrichtian: Maastricht.
?Coniacian: Tours (*fide* Canu).

AFFINITIES.

The occurrence of young zoœcia between those fully developed gives some specimens of this species the appearance of having occasional mesopores; but the series of specimens in the Museum Collection shows that the zoœcia are monomorphic.

The typical form consists of short, slightly bilobed stems, such as **D. 3604**; but these are connected by intermediate forms such as **D. 3760**, with erect stems such as **D. 3361**.

LIST OF SPECIMENS.

D. 1399. A slide with a thick massive zoarium, 10 mm. high and 10 mm. in diameter. It is labelled *Ceriopora polytaxis* by Vine. Maastrichter Kalk. Maastricht. Vine Coll.

D. 3288. Two zoaria (in tube), 5 × 6 mm. in diameter and 5 mm. high. The zoaria are large. The lamellar structure is distinct and so also is the absence of mesopores, though there are many young zoœcia. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3360. A zoarium with a hollow base, 11 × 6 mm. in diameter; an upper branch growing horizontally is 3 mm. in diameter. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3361. A long branch somewhat laterally compressed; it is 30 mm. long, is 8 mm. in diameter at the slight constriction above the base, and the upper part is 10 mm. wide and 7–8 mm. thick. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3403. Three young zoaria of nodular form and irregular upper surface (in tube). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3604. A young zoarium of the typical form slightly bilobed above; it is 6 mm. high and 5 × 3 mm. in diameter. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3760. A zoarium which divides above into two well-marked branches. It has a growth like a *Domopora*, but has no vertical rows of apertures. It is labelled "*Ceriopora cavernosa*" by M. Pergens. Maastrichter Kalk. Maastricht. Gamble Coll.

D. 3717. Two young zoaria (in tube) labelled "*Ceriopora polytaxis*" by M. Pergens. Maastrichter Kalk. Maastricht. Gamble Coll.

10. **Reptomulticava schweiggeri** (von Hagenow), 1851.

SYNONYMY.

Ceriopora schweiggeri,	von Hagenow, 1851.	Bry. maastr. Kr. p. 51, pl. v. fig. 1.
,, ,,	Hamm, 1881.	Bry. mastr. Ob.-Sen. i., Cycl. p. 36.
Reptomulticava ,,	d'Orbigny, 1854.	Bry. Crét. p. 1034.
,, ,,	Ubaghs, 1879.	Descr. Géol. Pal. Limb. p. 225.

DIAGNOSIS.

Zoarium massive and nodular, and may be sub-ovoid. The multilamellar structure very conspicuous owing to the thinness and regularity of the layers. Surface occasionally pitted.

Apertures crowded, small.

DIMENSIONS.

	Von Hagenow's type. mm.	D. 3603. mm.
Diameter of zoarium	17 × 27 ...	7 × 12
Thickness of zoœcial layer	·4–·5 ...	·5
Diameter of apertures	·05–·06 ...	—

DISTRIBUTION.

Senonian—Maastrichtian: Maastricht.

D. 3603. A worn nodule, 12 mm. high, 7 × 8 mm. in diameter. In places some young zoœcia resemble mesopores in appearance. Maastrichter Kalk. Maastricht. Van Breda Coll.

11. **Reptomulticava cavernosa** (von Hagenow), 1851.

SYNONYMY.

Ceriopora cavernosa, von Hagenow, 1851. Bry. maastr. Kr. p. 51, pl. v. fig. 3.
,, ,, Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 210.
non ,, ,, Etheridge & Newton, 1878. Cat. Cret. Foss. Mus. Pract. Geol. p. 6.
,, ,, *pars*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 36.
Reptomulticava ,, d'Orbigny, 1854. Bry. Crét. p. 1034.
,, ,, Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 225.
? *Domopora irregularis*, Hamm, 1881. *Op. cit.* p. 42.

DIAGNOSIS.

Zoarium large, with the tubercular character of the upper surface well developed. The zoarium is composed of numerous thin superposed layers with abundant free interspaces between them.

Apertures small, crowded, and irregular in arrangement.

Zoœcia about ·07 mm. in diameter.

DISTRIBUTION.

Senonian—Maastrichtian: Maastricht; Ciply.

AFFINITIES.

Hamm includes *Radiopora stellata*, Simon, as a synonym of this species, and that opinion suggests that *R. cavernosa* may have its apertures in radial series and be a *Radiopora*. Hamm's *Domopora irregularis* is probably the same species as von Hagenow's *cavernosa*.

Von Hagenow's excellent figures show, however, that his *C. cavernosa* has a multilamellar zoarium and crowded, non-radial apertures, and a specimen in the Museum Collection (**D. 3606**) agrees with von Hagenow's figure in both respects. The structure is that of *Reptomulticava* with numerous interspaces between the lamellæ. The record of this species at Farringdon is based on specimens of *Radiopora neocomiensis* (d'Orb.).

The *Heteropora substellata* of Pergens & Meunier (cf. p. 141) and the *Ceriopora uva* of Hennig (cf. p. 152) may both be founded on this species, but the zoœcia of the latter are so much larger that it is left as a distinct species.

D. 3606. A zoarium 35 × 25 mm. in diameter and 23 mm. thick. The average sub-colonies are 4 mm. in diameter, the limits being from 3 to 5 mm. Maastrichtian. Ciply. Van Breda Coll.

UNREPRESENTED SPECIES.

1. **bellula**, de Loriol, 1869.

Syn. *Reptomulticava bellula*, de Loriol & Gillieron, 1869. Mon. Urg. inf. Landeron: Mém. Soc. helvét. Sci. nat. vol. xxiii. p. 41, pl. iii. figs. 9–11.

Char.—Zoarium pedunculate, irregular upper surface, ridged by the edges of the numerous overlapping layers; zoœcia large; forty to fifty apertures per square mm. (*fide* de Loriol).

Distrib.—Lower Urgovian: Landeron, Neuchatel.

2. ? **capitata** (Römer), 1839.

Syn. *Millepora capitata*, Römer, 1839. Verst. nordd. Ool.: Nachtrag, p. 13, pl. xvii. fig. 10.

Ceriopora spongiosa, Römer, 1840. Verst. nordd. Kr. p. 23.

Char.—Nodular zoarium, very fine pores. The figure given by Römer suggests that it is not a Bryozoan; but his description a year later renders it possible that it may be a *Reptomultisparsa*.

Distrib.—Neocomian: Schöppenstedt, Brunswick.

3. **cepularis**, Gabb & Horn, 1860.

Syn. *Reptomulticava cepularis*, Gabb & Horn, 1860. Descr. Cret. Cor. N. Jersey: Proc. Acad. Nat. Sci. Phil. 1860, p. 367.

,, ,, Gabb, 1860. New Amer. Tert. Cret. Foss.: Journ. Acad. Nat. Sci. Phil. ser. 2, vol. iv. p. 401, pl. lxix. figs. 33–5.

Reptomulticava cepularis, Gabb & Horn, 1862. Mon. Foss. Polyz.: Journ. Acad. Nat. Sci. Phil. ser. 2, vol. v. p. 177.
,, ,, Meek, 1864. List Invert. Foss. Cret. p. 4.
,, ,, Johnson, 1905. Annot. List: Proc. Acad. Nat. Sci. Phil. p. 5.
,, ,, Weller, 1908. Cret. Pal. N. Jersey: Geol. Surv. N. Jersey, Pal. vol. iv. p. 340.

Char.—Zoarium of large incrusting masses (as much as 2½ inches in diameter) with irregularly tubercular or nodular surface. Apertures angular, crowded, and irregularly distributed.

Distrib.—Senonian—Maastrichtian: Timber Creek, New Jersey.

Aff.—The description suggests a species allied to *R. subirregularis* (d'Orb.), but the figure throws doubt on its identification as one of this family.

4. **cornuta** (d'Orbigny), 1854.

Syn. *Semimulticava cornuta*, d'Orbigny, 1854. Bry. Crét. p. 1031, pl. 791, figs. 1–3.

Char.—Zoarium dendroid, of irregular branches, which are sometimes thicker near their ends, but end in sharp points. Each branch consists of many layers around a hollow axis. Apertures circular.

Dimensions.

	D'Orbigny's figure.
Zoarium	60 mm.
Diameter of branches	4–8 ,,

Distrib.—Albian: Grandpré, Belgium.

Aff.—The type-specimen, according to M. Pergens (Rev. p. 387), is lost.

5. **digitalis** (d'Orbigny), 1854.

Syn. *Ceriopora digitalis*, d'Orbigny, 1854. Bry. Crét. p. 1031, pl. 791, figs. 8, 9.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 36.
Reptomulticava simplex, d'Orbigny, 1854. Bry. Crét. p. 1041, pl. 793, figs. 5–8.
,, ,, Pergens, 1890. Rev. p. 387.
? ,, ,, Gamble, 1896. Cat. Bry. Chatham, p. 4.
Ceriopora ,, Canu, 1903. Faune Cr. Villedieu: Bull. Soc. géol. France, ser. 4, vol. iii. p. 268.
? *Polytrema mamilla*, *pars*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 279.
? *Reptomulticava mamilla*, *pars*, d'Orbigny, 1854. Bry. Crét. p. 1041, pl. 793, figs. 3, 4.

Char.—Cylindrical or club-shaped, sub-pedunculate; rounded or bilobed above. Apertures somewhat irregular in size, and with a tendency towards a vertical arrangement.

Distrib.—Senonian—Maastrichtian: Sainte-Colombe, Manche; Pons, Charente-Inférieure.
Santonian: Saintes, Charente-Inférieure.
Coniacian: Vendôme, Loir-et-Cher; on d'Orbigny's records of *R. mamilla*, les Roches, Loir-et-Cher, Joué, Tours, and Luynes, Indre-et-Loire; Phelippeaux, Charente-Inférieure.
Stage indet.: Moutier, Charente, and Maune, Indre-et-Loire.

Aff.—Probably d'Orbigny's specimens of *R. mamilla*, which he identified with *Canalipora mammilla* (Reuss), belong to this species; his figures closely resemble his *digitalis*, though, as the zoarium is lower, both show superposed growth, and have a tendency to a vertical arrangement of the apertures. D'Orbigny placed the species in *Ceriopora*, but he remarks that it is composed of superposed layers, and shows this structure in his figure.

6. **flabellum** (Michelin), 1847.

Syn. *Chætetes flabellum*, Michelin, 1847. Icon. Zooph. p. 306, pl. lxxii. fig. 9.
Polytrema ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 209.
Reptomulticava flabellum, d'Orbigny, 1854. Bry. Crét. p. 1039, pl. 793, figs. 1, 2.
,, ,, Pergens, 1890. Rev. p. 387.
? ,, ,, Gamble, 1896. Cat. Bry. Chatham, p. 4.
Ceriopora flabellum, Bucaille, 1890. Bry. Crét. Seine Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 512.
Chætetes coquandi, Michelin, 1847. Icon. Zooph. p. 306, pl. lxxiii. fig. 3.
Polytrema ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 209.
Reptomulticava coquandi, d'Orbigny, 1854. Bry. Crét. p. 1039, pl. 792, figs. 12, 13.
,, ,, Toucas, 1873. Terr. crét. Beausset: Mém. Soc. géol. France, ser. 2, vol. iv. pp. 41, 44.
,, ,, Pergens, 1890. Rev. p. 387.

Char.—Massive, large, broad-based zoarium, with regular upper surface. Apertures large, subcircular, crowded.

Distrib.—Turonian: Rennes, Corbières, and Soulage, Aude; Alais, Gard; Beausset and Mazaugues, Var; Figuières, Bouches-du-Rhone.

7. ? **incrustata** (von Hagenow), 1840.

Syn. *Ceriopora incrustata*, von Hagenow, 1840. Mon. Rüg. pt. ii.: N. Jahrb. p. 647.

Char.—"Zoarium irregularly club-shaped, of the stoutness of a goose-quill." Composed of four superposed lamellæ. Apertures very minute, and irregularly distributed over the whole upper surface.

Distrib.—Senonian—Campanian: Rügen.

Aff.—Doubtful. It may be a *Reptomulticava*, but the fact that the pores are invisible to the naked eye suggests doubts whether the fossil be a Bryozoon at all.

8. **licheniformis** (Michelin), 1846.

Syn. *Ceriopora licheniformis*, Michelin, 1846. Icon. Zooph. p. 205, pl. lii. fig. 5; *non* p. 323, pl. lxxvii. fig. 11 (which was renamed, in 1848, in the errata, p. 348, *C. lichenula*).
? ,, ,, Thomas & Peron, 1893. Descr. invert. foss. terr. crét. sud. Tunisie, pp. 344–6.
non Radiopora ,, d'Orbigny, 1854. Bry. Crét. p. 993.
Semimulticava ,, d'Orbigny, 1854. *Ibid.* p. 1031.

Char.—Zoarium a large, broad, flat, massive incrustation, with irregularly pitted upper surface and concentrically wrinkled under surface. (Type-specimen 48 × 30 mm. diameter; Tunis specimens reach 110 mm. across.) The zoœcia are crowded, uniform in size, and quite irregular in arrangement; minute (*fide* Michelin, who describes the aperture as *minutissimus*).

Distrib.—Cenomanian: Le Mans; ? El Aïeïeha, Tunis.

Aff.—D'Orbigny describes the zoarium as composed of many layers. The species resembles Michelin's own figure of *C. mamillosa*, Röm. (Mich. pl. lii. fig. 12), in which the zoarium is raised into humps instead of being flat, and the surface is marked by blunt, broad tubercles instead of shallow pits. Thomas & Peron remark its very close affinity to *R. flabellum*, which they keep distinct only on the ground of its Turonian age. Whether the Tunisian specimens are correctly identified with this species appears a little doubtful, for the authors of that identification remark that the fossils present great analogies with '*Ceriopora*' *letourneuxi*, which appears to be a sponge.

9. **mamillata** (d'Orbigny), 1850.

Syn. *Polytrema mamillata*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 209.
Reptomulticava mamillata, d'Orbigny, 1854. Bry. Crét. p. 1040, pl. 794, fig. 1.
,, ,, Toucas, 1873. Terr. crét. Beausset: Mém. Soc. géol. France, ser. 2, vol. ix. pp. 42, 44.
,, ,, Pergens, 1890. Rev. p. 387.
non ,, ,, Vine, 1893. Rep. Cret. Polyz.: Rep. Brit. Assoc. 1892, p. 333.
,, ,, ,, Gamble, 1896. Cat. Bry. Chatham, p. 4.

Char.—A large irregularly mammillated zoarium, with very small apertures.

Distrib.—Turonian: Le Beausset, Var.

Aff.—This species is separated from *R. flabellum* by its mammillated zoarium. It is possibly a *Ceriopora*, though a lamellar structure is clearly suggested by d'Orbigny's figure; and in that case its nearest ally would be *C. irregularis*, from which it would differ by its much smaller apertures.

There are two slides (**D. 704–5**) in the Vine Collection upon which this species has been recorded from the Chalk of Chatham and Gravesend. These specimens, however, are not Bryozoa.

D. 704. Four specimens (on slide). Upper Chalk. Gravesend. Vine Coll., No. 188. Identified by Vine as *Reptomulticava mamilla*, d'Orb.

D. 705. Two specimens (on slide). Middle Chalk. Chatham. G. R. Vine Coll., No. 193. Identified by Vine as *Reptomulticava mamillata* ?, d'Orb.

10. **mamillosa** (Römer), 1840.

Syn. *Ceriopora mamillosa*, Römer, 1840. Verst. nordd. Kr. p. 23, pl. v. fig. 25.
,, ,, d'Archiac, 1846. Crét. versants plat. centr.: Mém. Soc. géol. France, ser. 2, vol. ii. No. 1, p. 93.
,, ,, Michelin, 1846. Icon. Zooph. p. 207, pl. lii. fig. 12.
,, ,, Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 210.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 46.
non ,, (*Multicrescis*) *mamillosa*, Etheridge & Newton, 1878. Cat. Cret. Foss. Mus. Pract. Geol. p. 6.
Monticulipora mamillosa, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 279.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 225.
Reptonodicava ,, d'Orbigny, 1854. Bry. Crét. p. 1015.

Char.—Zoarium a piriform nodule, rising from a concave lower surface; surface mammillated.

Distrib.—Senonian—Maastrichtian: Maastricht (*fide* Winkler); Gacé, Central France (*fide* d'Archiac).
Oberkreidemergel: Goslar, Germany (*fide* Römer; the type locality).
Cenomanian: Le Mans.

Aff.—That this species is a *Reptomulticava* is most probable from the figure given by Michelin. Perhaps *C. phymatodes*, von Reuss, should be included as a synonym (p. 138).

11. **nodosa** (Keeping), 1883.

Syn. *Ceriopora* (*Reptonodicava*) *nodosa*, Keeping, 1883. Foss. Neoc. Upware, p. 140, pl. vii. fig. 14.

Char.—Zoarium large, massive, concave. The upper surface is covered with prominent, well-raised mammillæ. The specimens, according to Keeping, are as much as 4 × 4 × 8½ inches in size.

Distrib.—Lower Greensand: Brickhill, Upware.

Aff.—Nearly allied to *R. mamillosa*, from which it differs by its larger size, larger zoœcia, and more prominent mamelons. Keeping describes it as having a lamellar structure, so it must be excluded from *Ceriopora*.

12. **orbiculata** (Thomas & Peron), 1893.

Syn. *Ceriopora orbiculata*, Thomas & Peron, 1893. Descr. invert. foss. terr. crét. sud. Tunisie, p. 348.
Radiopora ,, Thomas & Peron, 1893. *Ibid.* pl. xxx. figs, 20, 21.

Char.—Zoarium large and massive, globular or sometimes discoid; as large as 80 mm. in diameter; it is composed of thin lamellæ. Upper surface irregularly mammillate. Apertures angular or subangular; general diameter from ·2 to ·25 mm.

Distrib.—Senonian—Santonian: Southern Tunis.

Aff.—According to the authors of the species it differs from *Reptomulticava irregularis*, d'Orbigny, which is a Turonian species, by its more evenly rounded surface and lower mammillæ. The distinction is not great, but as it appears to be constant in the numerous specimens of the two horizons and localities, the two species may be accepted. The figures give no evidence of affinities with *Radiopora*.

13. **pseudo-tuberosa** (d'Orbigny), 1850.

Syn. *Ceriopora tuberosa* (*non* Römer), Michelin, 1846. Icon. Zooph. p. 208, pl. liii. fig. 1.
Polytrema pseudo-tuberosa, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 184.
Reptomulticava ,, d'Orbigny, 1854. Bry. Crét. p. 1034.

Char.—Zoarium nodular with smooth surface. Apertures apparently very large (*fide* Michelin's figure) with raised rims. Depressions between the rims have some resemblance to mesopores.

Distrib.—Cenomanian: Le Mans.

14. **pyriformis,** d'Orbigny, 1854.

Syn. *Reptomulticava pyriformis*, d'Orbigny, 1854. Bry. Crét. p. 1037, pl. 792, figs. 4, 5.
,, ,, Pergens, 1890. Rev. p. 388.

Char.—A piriform, massive zoarium, 60 mm. long, with the surface marked by numerous circular zoœcial groups. According to Pergens, the species is founded on a worn indeterminable specimen. It is a very close ally of *R. mamillosa* (Röm.).

Distrib.—Aptian: Sainte-Croix, Vaud.

15. **subirregularis** (d'Orbigny), 1850.

Syn. *Polytrema subirregularis*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 279.
Reptomulticava ,, d'Orbigny, 1854. Bry. Crét. p. 1042, pl. 794, figs. 2, 3.
,, ,, Pergens, 1890. Rev. p. 387.

Char.—Irregular lamellar zoarium, with the surface covered by disc-shaped elevations. Zoœcia narrow with small apertures.

Distrib.—Senonian: Moutier, Charente.
Maastrichtian: Royan.
Santonian: Saintes, Charente-Inférieure.
Coniacian: Tours, Indre-et-Loire; Vendôme, Loir-et-Cher.

Aff.—This species resembles *R. pyriformis* in its disc-shaped elevations.

16. **tuberculata** (d'Orbigny), 1854.

Syn. *Semimulticava tuberculata*, d'Orbigny, 1854. Bry. Crét. p. 1032, pl. 791, figs. 4–7.
Ceriopora (*Semimulticava*) *tuberculata*, Pergens, 1890. Rev. p. 387.
? ,, *tuberculata*, Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 508.

Char.—Zoarium of hollow, multilamellar stems, which branch irregularly. The apertures are irregular in shape and crowded. The surface of the zoarium is marked by flat tubercles, due to zoœcial groups.

Distrib.—Senonian—Coniacian: Tours.
? Cenomanian: Seine-Inférieure (*fide* Bucaille).

17. **uva** (Hennig), 1894.

Syn. *Ceriopora uva*, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. pp. 37–9, pl. ii. figs. 37–9, and fig. 23, p. 38.

Char.—Zoarium massive, with tubercular surface. The sub-colonies are about 5 mm. in diameter and have a circular area of crowded apertures; the outer zoœcia are sub-radial, flattened with angular apertures ·17 × ·09 mm. in diameter.

Distrib.—Senonian—Campanian—Zone of *Belemnitella mucronata*: beds with *Actinocamax mamillatus* at Balsberg, V. Olinge, Ifö, and Barnakällegrottan, Sweden.

Aff.—This Bryozoan differs from *R. cavernosa* only by the larger size of its zoœcia and the less cavernous character of the zoarium. In all probability Pergens & Meunier's record of *Heteropora substellata* from Faxoe (*vide* p. 141) is based on *R. uva*. Not having access to a specimen from Faxoe or of Hennig's *R. uva*, I feel bound to leave the records as they stand, though in all probability both should be included in the synonymy of *R. cavernosa* (cf. p. 146).

18. **variabilis** (d'Orbigny), 1853.

Syn. *Semicava variabilis*, d'Orbigny, 1854. Bry. Crét. p. 1029, pl. 790, figs. 14–20.
,, ,, Canu, 1900. Bry. Tours: C.R. Assoc. franç. Av. Sci. 1899, p. 410.

Char.—Zoarium hollow, tuberous to cylindrical, very variable. Branches dichotomous, crowded. According to Pergens (Rev. p. 387) it is founded on worn, indeterminable specimens.

Distrib.—Senonian: Maune, Indre-et-Loire.
Santonian: Saintes, Charente-Inférieure.
Coniacian: Vendôme, les Roches, and Villedieu, Loir-et-Cher; Luynes, Tours, Joué, St. Christophe, Indre-et-Loire.

DEFRANCIOPORA, Hamm, 1881.

[Bry. mastr. Ob.-Sen. i., Cycl. p. 39.]

SYNONYMY.

Defrancia, pars, von Hagenow, 1851.
Domopora, pars, d'Orbigny, 1854; Vine, 1885.
Ceriopora, pars, von Hagenow, 1851; Ubaghs, 1890.
Multelea, pars, Beissel, 1865; Ubaghs, 1890.

DIAGNOSIS.

Ceriocoridæ with a compound zoarium, formed of several saucer-shaped or discoid sub-colonies in a vertical series.

The apertures cover the upper, outer rim of the sub-colonies; the lower exposed surface of each sub-colony is covered by a calcareous layer (epizoarium). The zoœcia on the upper surface are radially arranged around a central area of crowded apertures.

TYPE SPECIES.

Defranciopora cochloidea (von Hagenow): Bry. maastr. Kr. p. 42, pl. iv. fig. 8. Maastrichter Kalk: Maastricht.

AFFINITIES.

This genus has the apertures crowded in narrow, horizontal bands around the zoarium. The zoœcia are simple in structure, as is shown by Pl. VII. Fig. 6*b*, in which the apertures appear of the same nature, though the sizes vary according to the wearing down of the margin of the sub-colonies.

Hamm placed the genus in his group the *Ceriopora*, and between the genera *Zonatula* and *Inversaria*.

1. Defranciopora cochloidea (von Hagenow), 1851.

SYNONYMY.

Defrancia cochloidea, von Hagenow, 1851. Bry. maastr. Kr. p. 42, pl. iv. fig. 8.
non Domopora ,, d'Orbigny, 1854. Bry. Crét. p. 990, pl. 781, figs. 5–7.
,, (*Defrancia*) *cochloidea*, Vine, 1885. Fifth Report: Rep. Brit. Assoc. 1884, p. 151.
Defranciopora cochloidea, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 39.

DIAGNOSIS.

Zoarium cylindrical and annulated. It is built up of a vertical pile of bun-shaped segments, which are well rounded above and concave below. The apertures occur in oblique rows on the upper surface of each segment; from two to five apertures remain exposed in each row. The apertures on the outer zone of the upper surface are radial in arrangement (*fide* von Hagenow).

DIMENSIONS.

	mm.
Height of zoarium	4·3
Diameter of zoarium	3·5
Diameter of apertures	·06–·1

DISTRIBUTION.

Senonian—Maastrichtian: Maastricht.

FIGURES.

Pl. VII. Fig. 1. A zoarium from the Maastrichter Kalk, Maastricht. Fig. 1*a*, the zoarium from the side; × 6 dia. Fig. 1*b*, end view; × 10 dia. Gamble Coll. **D. 3777.**

AFFINITIES.

This species is the type of the genus, and is represented by a specimen in the Gamble Collection, which had been determined by M. Pergens. The first examination of the specimen led me to regard it as allied to *Reptomulticava*, and possibly only a variety of the *Reptomulticava* common in the Maastricht Chalk; it differs from that Bryozoon, however, in the size of the apertures as well as in the structure of the zoarium.

D. 3777. A zoarium (in tube). Maastrichter Kalk. Maastricht. Identified as *Defrancia cochloidea* by M. Pergens. Gamble Coll. Figd. Pl. VII. Fig. 1.

2. **Defranciopora libiformis,** Gregory, 1909.

SYNONYMY.

Defranciopora libiformis, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 63.

DIAGNOSIS.

Zoarium of saucer-shaped or cup-shaped sub-colonies, with the base of one resting in the cavity of the sub-colony below. The rims are well rounded and wide.

Apertures often in oblique series of three or four in a row, but in some parts of the zoarium the arrangement is irregular.

The sides of the sub-colonies, except on the rim, are smooth and imperforate.

DIMENSIONS.

	D. 1398. mm.
Height of zoarium	5·5
Diameter of zoarium	3·5
Width of rim	·7–·8
Diameter of apertures	·3–·4

DISTRIBUTION.

Senonian—Maastrichtian : Maastricht.

FIGURES.

Pl. VI. Fig. 6*a*. The type-specimen from the side; × 6½ dia. Fig. 6*b*, part of the rim of one segment ; × 30 dia. Maastrichter Kalk : Maastricht. Vine Coll. **D. 1398.**

AFFINITIES.

Vine identified the type-specimen as *Defrancia cochloidea.* It appears, however, to differ sufficiently from that species to be worthy of specific separation. The differences are that the zoarium consists of saucer-shaped instead of solid sub-colonies, and the apertures are confined to the outer rim of the segments.

D. 1398. Two specimens (on slide). Maastrichter Kalk. Maastricht. Identified as *Defrancia cochloidea* by Vine. G. R. Vine Coll. Figd. Pl. VI. Fig. 6.

3. ? **Defranciopora sessilis** (von Hagenow), 1851.

SYN. *Ceriopora sessilis*, von Hagenow, 1851. Bry. maastr. Kr. p. 53, pl. v. fig. 7.
,, ? ,, Ubaghs, 1890. Descr. Géol. Pal. Limb. p. 225.
Defranciopora sessilis, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 39.
? *Multelea sessilis*, Beissel, 1865. Bry. Aach. Kr. : Natuurk. Verh. Holl. Maatsch. Wet. vol. xxii. p. 11.
,, ,, Ubaghs, 1890. Descr. Géol. Pal. Limb. p. 222.

CHAR.—Zoarium a small thick disc, with minute apertures arranged in curved or straight intercrossing lines.

DISTRIB.—Senonian—Maastrichtian : Maastricht.

AFF.—This species may be represented in the collection by **D. 4268**, a fossil labelled by M. Pergens *Ceriopora sessilis*, Hag. = *Reptomulticava cupula*, d'Orb. ; but he adds "not large enough to identify with certitude." This specimen is not a Bryozoon, but, so far as can be judged from von Hagenow's figures, neither is the type of *C. sessilis*.

? **4268.** A ring-shaped fossil which is not a Bryozoon, though identified as *Ceriopora sessilis.* Middle Chalk — zone of *Micraster cortestudinarium.* Chatham. Gamble Coll.

CERIOPORA, Goldfuss, 1827.

[Petref. Germ. vol. i. p. 33.]

SYNONYMS.

Polytrema, pars, d'Orbigny, 1850–1.
Chætetes, pars, Michelin, 1846.
Reptomulticava, pars, d'Orbigny, 1853; Ubaghs, 1879; Pergens, 1890.
Ceriocava, d'Orbigny, 1854; de Loriol, 1868.
Ceriopora, pars, Hennig, 1894; Ulrich, 1900; etc.

DIAGNOSIS.

Cerioporidæ with prismatic or sub-cylindrical zoœcia. Mesopores absent. Acanthopores absent. Walls of zoœcia thin. Diaphragms numerous and horizontal. Zoarium massive or branching.

TYPE SPECIES.

C. micropora, Goldfuss, 1827: Petref. Germ. p. 33, pl. x. fig. 4*d*, *non* figs. 4*a–c*. Senonian—Maastrichtian: Maastricht. The type-specimen has been refigured by von Hagenow, 1851: Bry. maastr. Kr. pl. v. fig. 4.

AFFINITIES.

Goldfuss founded the genus *Ceriopora*, and included in it twenty-eight species, of which the first in the list was his *Ceriopora cryptopora*, which is here regarded as a *Heteropora*. His second species, *C. micropora*, is the most convenient type, as de Blainville in 1830 and again in 1834[1] placed the species *cryptopora* in a new genus, *Heteropora*, distinguished by its dimorphic zoœcia.

De Blainville redefined *Ceriopora* as follows[2]:—"Animaux inconnus, contenus dans des cellules poriformes, rondes, serrées, irrégulièrement éparses, et formant par leur réunion et leur agglomération en couches concentriques, un polypier calcaire, polymorphe, mais le plus souvent globuleux ou lamelleux." The four species he included in it were—

C. micropora, Goldfuss.
C. verrucosa, Goldfuss, pl. x. fig. 6 = *Stromatopora polymorpha* (Goldf.).
C. polymorpha, Goldf., pl. x. fig. 7 = *Palmipora polymorpha*.
C. compressa, Goldf., pl. xi. fig. 4 = *Diastopora compressa* (Goldf.): cf. this Catalogue, Vol. I. p. 132.

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[1] Manuel d'Actinologie, p. 417.

[2] De Blainville. Zooph. Dict. Sci. nat. 1830, vol. lx. p. 378.

De Blainville did not definitely state that the zoœcia were of uniform size in *Ceriopora*, but this fact follows from his diagnosis of *Heteropora*, wherein he includes[1] those species of *Ceriopora* which have the "Cellules rondes, poriformes, complètement immergées, de deux sortes, les unes bien plus grandes que les autres."

The course adopted by de Blainville was essentially that followed by d'Orbigny in 1854, as he placed *Ceriopora* in his family the Cavidæ, a family which is "sans pores spéciaux, ni pores intermédiaires. Les cellules égales . . ." The essential difference between *Ceriopora* and *Heteropora* is that *Ceriopora* is monomorphic and *Heteropora* dimorphic.

The genus *Ceriopora*, as defined by d'Orbigny in 1854, was limited to five species, of which two, *tubiporacea* and *milleporacea*, have been assigned (Vol. I. pp. 350–1) to *Inversaria*; the three remaining species are *C. truncata* (Mich.), *C. digitalis* (d'Orb.), and *C. micropora*, Goldf. As the last of these was the only one also placed by Goldfuss in the genus, it is the proper type species.

The structure of *Ceriopora* was represented by de Blainville in 1830 and by d'Orbigny in 1854 as multilamellar; to quote d'Orbigny's own terms (Bry. Crét. p. 1029) each branch "est pourvue de plusieurs couches superposées et s'enveloppant les unes les autres." But in 1850 d'Orbigny had founded the genus *Reptomulticava* for the multilamellar species and retained *Ceriopora* for the massive, non-lamellar species. D'Orbigny, however, abandoned this arrangement in 1854, and then used *Reptomulticava* for the nodular and *Ceriopora* for the branched species.

His original view of 1850 seems, however, to be better than the amendment, and I prefer to follow the first definition, for the lamellar structure seems more important than the difference between nodular or branched zoaria. A certain amount of marginal lamellation must be expected in massive Bryozoa, for they increase in breadth by the overlap of the upper growing edge. The marginal or basal lamellation thus caused can be seen in d'Orbigny's figure of *C. digitalis* (Bry. Crét. pl. 791, fig. 9), and is suggested in von Hagenow's figure of the broken base of *C. micropora* (Bry. maastr. Kr. pl. v. fig. 4*b*), where the central area consists of vertical zoœcia seen in transverse section, while the outer horizontal zoœcia are seen in longitudinal section. This marginal lamellation around a massive zoarium of long zoœcia, as in *Ceriopora confusa* (*vide* Fig. 43, p. 165), is very different from the structure illustrated by Fig. 39, p. 136, in which the whole zoarium consists of a succession of thin layers.

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[1] *Ibid.* p. 381.

1. **Ceriopora micropora**, Goldfuss, 1827.

Synonymy.

Ceriopora micropora, *pars*, Goldfuss, 1827. Petref. Germ. vol. i. p. 33, pl. x. fig. 4*d*, *non* figs. 4*a–c*.
,, ,, *pars*, Morren, 1829. Corall. foss. Belg.: Ann. Acc. Groning. 1828, p. 38.
,, ,, *pars*, de Blainville, 1830. Zooph.: Dict. sci. nat. vol. lx. p. 378.
,, ,, *pars*, de Blainville, 1834. Man. d'Act. p. 413.
? ,, ,, Dubois de Montpéreux, 1836. Géol. Cauc. et Crimée: Bull. Soc. géol. Fr. vol. viii. opp. p. 385.
? ,, ,, de Verneuil, 1838. Géol. Crimée: Mém. Soc. géol. Fr. vol. iii. p. 21.
,, ,, von Hagenow, 1839. Mon. Rüg. Kr.: N. Jahrb. p. 282.
,, ,, *pars*, Römer, 1840. Verst. nordd. Kr. p. 23.
,, ,, von Hagenow, 1851. Bry. maastr. Kr. p. 52, pl. v. fig. 4.
,, ,, ? Kade, 1852. Los. Verst. Schanzenb. p. 32.
,, ,, d'Orbigny, 1854. Bry. Crét. p. 1030.
? ,, ,, Baily, 1858. Invert. Crimea: Quart. Journ. Geol. Soc. vol. xiv. pp. 155, 156.
,, ,, *pars*, Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 210.
?*non* ,, ,, Frič, 1869. Pal. Stud. böhm. Kr.: Arch. naturw. Landesf. Böhm. vol. i. pt. ii. p. 222.
,, ,, ,, Simonowitsch,[1] 1871. Bry. Essen. Grüns.: Verh. nat. Ver. preuss. Rheinl. vol. xxviii. p. 50.
,, ,, ,, von Reuss, 1872. Bry. unt. Quad.: Palæontogr. vol. xx. pt. i. p. 127, pl. xxxi. figs. 6, 7.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 225.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 36.
,, ,, Marsson, 1887. Bry. Rügen: Pal. Abh. vol. iv. pt. i. p. 44.
non ,, ,, Vine, 1890. Bry. Red Chalk: Quart. Journ. Geol. Soc. vol. xlvi. p. 480.
,, ,, ,, Vine, 1891. Polyz. Red Chalk: Proc. Yorks. Geol. Soc. vol. xi. p. 382.
,, ,, ,, Vine, 1891. Rep. Cret. Polyz.: Rep. Brit. Assoc. 1890, p. 396.
,, ,, ,, Vine, 1892. Addit. Cret. Polyz.: Proc. Yorks. Geol. Soc. vol. xii. p. 152.
,, ,, ,, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 334.

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[1] Vide *Reptomulticava avellana*, p. 138.

Ceriopora micropora, *pars*, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. pp. 36, 37, text-fig. 21.
non Reptomulticava micropora, Vine, 1889. Polyz. Greensd.: Proc. Yorks. Geol. Soc. vol. xi. p. 258.
,, ,, ,, Vine, 1891. Rep. Cret. Polyz.: Rep. Brit. Assoc. 1890, p. 384.
Ceriopora theloidea, von Hagenow, 1851. Bry. maastr. Kr. p. 52, pl. v. fig. 5.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 36.
,, ,, Vogel, 1892. Ob. Sen. Irnich: Verh. nat. Ver. preuss. Rheinl. vol. xlix. p. 92.
Reptomulticava theloidea, d'Orbigny, 1854. Bry. Crét. p. 1034.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 225.
,, ,, Ubaghs, 1888. C.R. Excursion: Bull. Soc. belge Géol. vol. i., Mém. p. 233.

DIAGNOSIS.

Zoarium spherical, piriform, or irregularly tuberous; it has usually a projecting base and tends to become sub-pedunculate.

Zoœcia short, regular in size, with very few tabulæ. Apertures small, irregular, somewhat variable in size, and often angular.

DIMENSIONS.

	micropora, Hag. mm.	*theloidea*, Hag. mm.
Diameter of zoarium	16	4–6
Height of zoarium	14	6–12
Diameter of apertures	·07–·1	·07
Number of apertures (per sq. mm.)	58	70

DISTRIBUTION.

Senonian: Irnich, north of Eifel (*fide* Vogel); Gehrden and Goslar (*fide* Römer).
Maastrichtian: Maastricht. Lower Maastrichtian: Kunraed (*fide* Ubaghs).
Campanian: Rügen. Zone of *Belemnitella mucronata*: Köpinge and Mörby, Sweden; beds with *Actinocamax mamillatus*, Balsberg, Ignaberga, Ifö, Gröpemollan, etc., Sweden.
[1] ? Cenomanian—Marne bleuâtre—Zone of *Pecten asper*: Baktchserai, Crimea.
[1] ? Neocomian: Baktchserai, Crimea.

AFFINITIES.

This species is one of several with the synonymy confused, owing to Goldfuss having figured more than one fossil under the same name. He gave the range of the species as including

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[1] Reported from both horizons by Dubois de Montpéreux, de Verneuil, and Baily. Possibly this record may be based on *Reptomulticava micropora* (Römer).

Petersberg near Maastricht, the marl of Essen on the Ruhr, and the upper chalk of "Cleom bei Nantu." He does not say from which locality his figured specimens came. He gave four figures, *a–d*, and he draws dotted lines uniting respectively *b* with *c* and *a* with *d*, thus suggesting that figure *d* is a magnified view of part of the surface of the specimen shown in figure *a*, and the specimen appears to be from Maastricht. De Blainville, in 1830,[1] interpreted the figures in this way, as he took the two figures *a* and *d* as *C. micropora*. The figures *b* and *c* are views of the same specimen, as that fact is expressly stated by Goldfuss (*op. cit.* p. 33); it is, however, not a Bryozoon, and is probably a Cenomanian sponge from Essen.

It appears, however, from the study of Goldfuss's type-specimens by von Hagenow that the figures *a* and *d* are not of the same specimen, but of specimens of different genera. *C. micropora*, Goldf., therefore includes three distinct fossils. According to von Hagenow the figures in Goldfuss, pl. x. fig. 4, must be classified as follows:—

Goldfuss, pl. x. fig. 4*a*, is a *Heteropora*, and refigured by von Hagenow as the type of *H. crassa*, Hag.: Bry. maastr. Kr. pp. 46, 52, pl. v. fig. 13.

Do. figs. 4*b*, *c*, *fide* von Hagenow (p. 52), represent a sponge of the genus *Achilleum*.

Do. fig. 4*d* is left as the type of *C. micropora*, and has been refigured as such by von Hagenow, *op. cit.* p. 52, pl. v. fig. 4.

Von Hagenow admitted an element of doubt in reference to fig. 4*d*; but he believed that Goldfuss's figure, pl. x. fig. 4*d*, represented a magnified part of the globular specimen, which von Hagenow figured as the type of *micropora* in his pl. v. fig. 4.

Under the circumstances it seems to me clear that we have to follow von Hagenow in his selection of the specimen shown in his pl. v. fig. 4 as the type of *Ceriopora micropora*.

The forms included here by Simonowitsch and von Reuss are transferred to *Reptomulticava avellana* (Mich.). Von Reuss unfortunately does not give dimensions, and the magnification of his figures is not given. The fossils are described as having very small, crowded apertures and as being composed of concentrically arranged layers, indicating that the species belong to *Reptomulticava.* Simonowitsch describes the zoaria in his specimens as composed of layers separated by " gebogene parallele Linien."

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[1] De Blainville. Zooph.: Dict. Sci. nat. vol. lx. p. 378.

LIST OF SPECIMENS.

D. 3289. A clavate zoarium of the shape and structure of the var. *theloidea.* Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3756. Three zoaria of the var. *theloidea* (on slide). Identified as *H. theloidea* by M. Pergens. Maastrichter Kalk. Maastricht. Gamble Coll.

The following specimens, though not Bryozoa, were referred to this species by Vine :—

D. 414. A curved fragment of a fossil (on slide). Chalk—zone of *Micraster cortestudinarium.* Chatham. Vine Coll., No. 82.

D. 701. Two fragments of fossils (on slide), labelled *Ceriopora micropora,* Goldf. = *D. digitalis,* d'Orb., pl. 791, figs. 8, 9. Chalk—zone of *Micraster cortestudinarium.* Chatham. Vine Coll., No. 96.

2. **Ceriopora farringdonensis,** Gregory, 1909.

SYNONYMY.

Ceriopora farringdonensis, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 63.

DIAGNOSIS.

Zoarium nodular with tuberous upper surface, and sometimes sub-pedunculate below. The tubercles, which are sparse and low, pass into short, finger-shaped lobes. Surface smooth, but weathered specimens may look variolated owing to the formation of depressions. Surface, when well preserved, covered in places by a thin calcareous epizoarium, which closes most of the apertures.

Zooecia larger than the average of the genus; from twelve to twenty apertures per sq. mm. Walls thick and distinctly moniliform in longitudinal section.

Diameter of zooecia about ·2 mm.

DIMENSIONS.

	D. 3144.	55,111.	10,298.
	mm.	mm.	mm.
Zoarium	50 high	25 high 28 broad	35 38
Diameter of tuberous processes ...	14	—	6–8
Diameter of apertures	·2	—	—
Number of apertures per sq. mm....	20	12	20

Distribution.

Lower Greensand: Farringdon, Berks.

Figures.

Pl. V. Fig. 1. The upper surface of a zoarium; nat. size. Fig. 2, part of the surface of the same zoarium; × 8 dia. Lower Greensand: Farringdon. Mantell Coll. **10,298.**

Pl. V. Fig. 3. A more tuberous zoarium from the side; nat. size. Lower Greensand: Farringdon. Cunnington Coll. **55,111.**

Pl. V. Fig. 4. A young zoarium; nat. size. Lower Greensand: Farringdon. Sharp Coll. **D. 7291.**

Fig. 42. A section across part of a zoarium, showing some zoœcia cut longitudinally and some transversely; × 10 dia. Lower Greensand: Farringdon. J. Brown Coll. **D. 3144.**

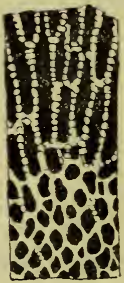

Fig. 42.—*Ceriopora farringdonensis*; × 10. **D. 3144.**

Affinities.

The species is a *Ceriopora* that looks variolate through occasional depressions around the larger zoœcia, and the surface is sometimes covered with a calcareous layer, penetrated in places by the apertures of single zoœcia. The nearest ally of this species is *C. confusa* (Lor.), from which it differs by having thick moniliform walls to the zoœcia and less crowded apertures; in *C. farringdonensis* there are about half as many apertures per square millimetre as there are in *C. confusa*.

LIST OF SPECIMENS.

10,298. A massive zoarium, the type-specimen. Lower Greensand. Farringdon. Mantell Coll. Figd. Pl. V. Figs. 1, 2.

55,111. A more tuberous zoarium. Lower Greensand. Farringdon. Cunnington Coll. Figd. Pl. V. Fig. 3.

D. 7291. A young zoarium. Lower Greensand. Farringdon. Sharp Coll. Figd. Pl. V. Fig. 4.

D. 3144. A zoarium with a thin section. Lower Greensand. Farringdon. J. Brown Coll. Section, figd. p. 162, Fig. 42.

D. 7293. A young clavate form. Lower Greensand. Farringdon. Cunnington Coll.

10,237. A massive tuberous zoarium and fragment of the end of a branch. Lower Greensand. Farringdon. Mantell Coll.

3. **Ceriopora collis** (d'Orbigny), 1854.

SYNONYMY.

Reptomulticava collis, d'Orbigny, 1854. Bry. Crét. p. 1036, pl. 792, figs. 1–3.
,, ,, Pergens, 1890. Rev. p. 386.
non ,, ,, Vine, 1889. Polyz. Greensd.: Proc. Yorks. Geol. Soc. vol. xi. p. 258.
,, ,, ,, Vine, 1890. Bry. Red Chalk: Quart. Journ. Geol. Soc. vol. xlvi. p. 481.
,, ,, ,, (? *ex syn.*) Vine, 1891. Polyz. Red Chalk: Proc. Yorks. Geol. Soc. vol. xi. p. 382.
,, ,, ,, Vine, 1892. Addit. Cret. Polyz.: *ibid.* vol. xii. p. 152, pl. vi. figs. 10–12.
,, ,, ,, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 333.
,, ,, ,, Gamble, 1896. Cat. Bry. Chatham, p. 4.

DIAGNOSIS.

Zoarium incrusting either as a flat sheet or raised as a broad rounded tubercle. Surface even.

Zoœcia with very small apertures, which are circular and well spaced.

DIMENSIONS.

Zoœcial apertures in specimens from Farringdon, and as far as can be measured from d'Orbigny's drawings, about ·1 mm. in diameter.

DISTRIBUTION.

BRITISH:

Lower Greensand: Farringdon.

FOREIGN:

Neocomian: Fontenoy and Saint-Sauveur, Yonne.

FIGURES.

Pl. V. Fig. 5*a*. A specimen attached to a Brachiopod; nat. size. Fig. 5*b*, part of the same; × 12 dia. Lower Greensand: Farringdon. **D. 3027.**

AFFINITIES.

The nearest ally of this species is *C. incrustans*, Reuss,[1] which has more crowded smaller apertures.

D. 3027. A specimen attached to a Brachiopod. Lower Greensand. Farringdon. Figd. Pl. V. Figs. 5, 5*b*.

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[1] Von Reuss. Verst. böhm. Kr. p. 63, pl. xiv. fig. 8.

4. **Ceriopora confusa** (de Loriol), 1868.

SYNONYMY.

Ceriocava confusa, de Loriol, 1868. Mon. Valang. Arzier: Pal. Suisse, ser. 4, pt. ii. p. 66, pl. vi. figs. 10, 12.

Ceriopora dumosa, de Loriol & Gilliéron, 1869. Mon. Urg. inf. Landeron: Mém. Soc. helvét. Sci. nat. vol. xxiii. p. 42, pl. iii. figs. 3, 4.

DIAGNOSIS.

Zoarium massive and tuberous, or spreading as a broad sheet, giving off short, thick, blunt processes or branches.

Zoœcia large; apertures of medium size, circular to oval, about ·2 mm. or slightly less in diameter, and about thirty to thirty-five per sq. mm.

DIMENSIONS.

	De Loriol's type of *confusa*.	De Loriol's type of *dumosa*.	Flat-based var. B.M. D. 3020. Pl. V. Fig. 9, and Fig. 43, p. 165.
	mm.	mm.	mm.
Diameter of zoarium	20	21	48 × 52
Diameter of processes	2–3	2–3	7 × 9
Diameter of apertures	—	—	·2–·16
Number of apertures per sq.mm. ...	35	30	27

FIGURES.

Pl. V. Fig. 9. A specimen of the typical, broad-based form; nat. size. Lower Greensand: Shanklin. Westlake Coll. **D. 3020.**

Fig. 43, p. 165. Part of a vertical section across part of the specimen figured as Pl. V. Fig. 9, showing both transverse and longitudinal sections of the zoœcia; × 12 dia. Lower Greensand: Shanklin. **D. 3020.**

DISTRIBUTION.

BRITISH:

Lower Greensand: Shanklin, Isle of Wight.

FOREIGN:

Lower Urgovian: Landeron, Switzerland.

AFFINITIES.

Among older species of *Ceriopora*, this *C. confusa* is allied to *C. arduennensis* (d'Orb.), which has a massive zoarium and crowded apertures; but it has a variolate surface, and the zoarium is nodular rather than tuberous. *C. irregularis* (Mich.) is another allied species, but the tendency of its zoarium is to become lobed or branched.

D. 3020. A massive, broad-based zoarium, the typical form. Lower Greensand. Shanklin. Caleb Evans Coll. Purchased from E. Westlake. Figd. Pl. V. Fig. 9, and Text-fig. 43.

5. **Ceriopora tuberosa** (Römer), 1839.

SYNONYMY.

Alveolites tuberosa, Römer, 1839. Verst. nordd. Ool., Nachtrag, p. 14, pl. xvii. fig. 9.
Ceriopora (*Alveolites*) *tuberosa*, Römer, 1840. Verst. nordd. Kr. p. 23.
non ,, *tuberosa*, Michelin, 1846. Icon. Zooph. p. 208, pl. liii. fig. 1.
non ,, ,, Kade, 1852. Los. Verst. Schanzenb. p. 32.
Polytrema ,, *pars*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 94.
Reptomulticava ,, *pars*, d'Orbigny, 1854. Bry. Crét. p. 1036, pl. 791, figs. 13, 14.

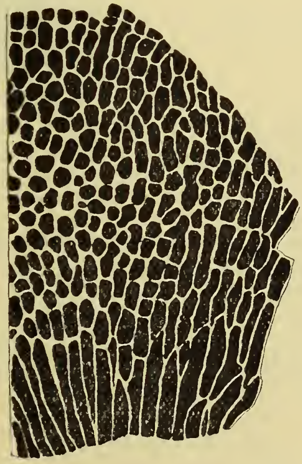

FIG. 43.—*Ceriopora confusa* ; × 12. **D. 3020.**

DIAGNOSIS.

Zoarium small; of short, thick, lobe-like branches from a flat base.

Zoœcia with small, crowded, circular apertures. Diaphragms numerous.

DIMENSIONS.

	Römer's type.	B.M. D. 3670.
	mm.	mm.
Height of zoarium	16 ...	15
Width of zoarium	16 ...	15
Diameter of apertures	— ...	·1

Distribution.

Hauterivian—Calcaire jaune: near Neuchatel.

Neocomian: Berklingen, Schöppenstedt, and Schandelahe, Brunswick; Goslar, Hannover.

Figures.

Fig. 44. A zoarium from the side; × 2 dia. Hauterivian—Calcaire jaune: near Neuchatel. Bruckmann Coll. **D. 3670.**

Fig. 45. Part of a thin vertical section through the same specimen; × 10 dia. **D. 3670.**

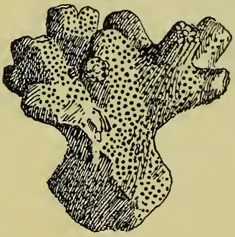

Fig. 44.—*Ceriopora tuberosa.* Zoarium; × 2. **D. 3670.**

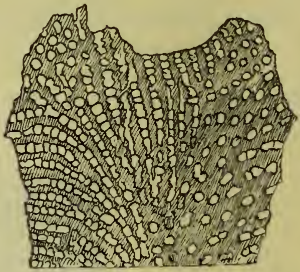

Fig. 45.—*Ceriopora tuberosa.* Vertical section; × 10. **D. 3670.**

Affinities.

For the relations of this species to *Reptomulticava canui*, in which d'Orbigny included it under the name *R. tuberosa*, see p. 130. Figures 44 and 45 of the zoarium and of a vertical section cut from it illustrate the general aspect and internal structure of this species. They show that it is monomorphic and not multilamellar, and that it is a true *Ceriopora.*

LIST OF SPECIMENS.

D. 3670. A small zoarium more branched than **D. 3647**, and with the apertures less clearly shown. Hauterivian—Calcaire jaune. Near Neuchatel. Bruckmann Coll. Fig. 44, and section, Fig. 45.

D. 3647. Three zoaria, each with a flat base and short, thick branches; they are from 10 to 13 mm. high. The apertures, where well preserved, are round and small. Neocomian—Hilsconglomerat. Berklingen, Brunswick. L. Saemann Coll.

D. 7075. One specimen included with *Multicrescis tuberosa* (Röm.). Neocomian. Goslar, Hanover. Purchased of F. Krantz, 1898.

D. 7077. Six specimens. Neocomian. Goslar, Hanover. Purchased of F. Krantz, 1898.

6. **Ceriopora ramulosa** (Michelin), 1846.

SYNONYMY.

Chætetes ramulosus, Michelin, 1846. Icon. Zooph. p. 202, pl. li. fig. 5.
Ceriopora ramulosa, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 184.
,, (*Ceriocava*) *ramulosa*, Pergens, 1890. Rev. p. 387.
Ceriocava ramulosa, d'Orbigny, 1854. Bry. Crét. p. 1017, pl. 788, figs. 11, 12.
non ,, ,, Gamble, 1896. Cat. Bry. Chatham, p. 4.
,, *mamillaris*, d'Orbigny, 1854. Bry. Crét. p. 1018, pl. 788, figs. 13, 14.
? ,, ,, Peron, 1888. Hist. Craie S.E. Bassin Anglo-Parisien: Bull. Soc. Sci. nat. Yonne, vol. xli. p. 264.
Ceriopora ,, Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 507.

DIAGNOSIS.

Zoarium of large, thick dichotomous branches, which are widely spreading. The branches range up to 30 mm. in diameter (*fide* d'Orbigny).

Apertures crowded, irregular in shape, and sometimes subtrigonal.

DISTRIBUTION.

BRITISH:
Upper Greensand: Warminster.
Upper Greensand (Albian)—Zone of *Schlœnbachia rostrata*: Haldon Hill, Devonshire.

FOREIGN:
Senonian—Zone of *Micraster breviporus*: Villecien (*fide* Peron).
Cenomanian: Le Mans, Sarthe; Cap la Hève, near Havre; Mazorgues, Var (horizon *fide* d'Orbigny, 1850); Montron and Mareuil, Dordogne.

AFFINITIES.

C. mamillaris is probably the young form and *C. ramulosus* the adult.

LIST OF SPECIMENS.

D. 7298. A small branch, 6 mm. long and 3 mm. across at its bilobed end, and a broken fragment. Upper Greensand. Warminster. Old Coll.

D. 7427. A zoarium rising from a thin base, 14 mm. across; the first stalk is 7 mm. in diameter; the branches are all given off from one side of the curved primary stem; the lowest branch is simple; the second branch has two blunt branches on the upper side, and is 12 mm. long. The height of the zoarium is 32 mm. The specimen is a siliceous pseudomorph, and the surface has been destroyed so that the identification is somewhat doubtful. Albian—zone of *Schlœnbachia rostrata*. Haldon Hill, south-west of Exeter. Bequeathed Vicary Coll., 1903.

UNREPRESENTED SPECIES.

1. aptiensis (d'Orbigny), 1854.

Syn. *Ceriocava aptiensis*, d'Orbigny, 1854. Bry. Crét. p. 1017.

Char.—Branches 4–5 mm. diameter, anastomosing. Zoœcial characters unknown.

Distrib.—Aptian: Sainte-Croix, Vaud.

2. arduennensis (d'Orbigny), 1850.

Syn. *Ceriopora polymorpha* (*non* Goldf.), Michelin, 1841. Icon. Zooph. p. 2, pl. i. fig. 4.
Polytrema arduennensis, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 143.
Reptomulticava arduennensis, d'Orbigny, 1854. Bry. Crét. p. 1034.

Char.—Massive, nodular zoarium; surface somewhat variolate. Pores very small, circular, crowded.

Distrib.—Aptian: Grandpré, Belgium.

Aff.—The *Ceriopora polymorpha* of Goldfuss (Petref. Germ. p. 34, pl. x. fig. 7, and pl. xxx. fig. 11) from Essen does not appear to belong to the Bryozoa.

3. ? bovista, von Hagenow, 1846.

Syn. *Ceriopora bovista*, von Hagenow, 1846. In Geinitz, Grundr. Verst. vol. ii. p. 595, pl. xxiii b, fig. 10.

Char.—A small clavate zoarium with crowded, irregularly arranged, equal apertures.

Distrib.—Senonian—Campanian: Scania, Sweden.

4. ? cæspitosa, Römer, 1840.

Syn. *Ceriopora cæspitosa*, Römer, 1840. Verst. nordd. Kr. p. 22, pl. v. fig. 28 (not fig. 29 as misprinted).
,, ,, Geinitz, 1840 and 1842. Char. säch.-böhm. Kr. pt. ii. p. 93, pl. xxiii. fig. 7; pt. iii. p. xx.
,, ,, von Reuss, 1846. Verst. böhm. Kr. p. 63.

Char.—Large massive zoarium, composed of closely attached, radial, dichotomous columns, which project on the upper surface as rounded tubercles. Römer describes the pores as small and hexagonal.

Distrib.—Senonian—Santonian (Kreidemergel): Südmergberg, near Goslar.
(Plänerkalk): Radowessitz and Kutschlin, Bohemia; Hundorf, Saxony.

Aff.—The columnar structure of the zoarium is a character common in *Radiopora*, but not in *Ceriopora*. However, there is no evidence that the apertures are radial, so the species is doubtfully retained in *Ceriopora*.

5. *non* **creplini** (Römer), 1841.

Syn. *Myriopora* (*Orbitulites*) *creplini*, Römer, 1841. Verst. nordd. Kr. p. 24.
,, *creplini*, von Reuss, 1846. Verst. böhm. Kr. p. 64, pl. xiv. fig. 7.
Orbitulites creplini, von Hagenow, 1839. Mon. Rüg.: N. Jahrb. p. 289.

Distrib.—Senonian—Campanian: Rügen.
Cenomanian—Lower Pläner: Schillinge, near Bilin.

Aff.—The genus is defined by Römer as "round cells forming only one layer; otherwise like *Ceriopora*." It is not the *Myriopora* of de Blainville, 1830, and the species is recorded by C. D. Sherborn (Index to Species and Genera of Foraminifera, Smithsonian Misc. Coll. No. 856, 1893, p. 283) among the Foraminifera as an *Orbitulites*. The species, despite the above-quoted remark by its founder, is not a Bryozoan.

6. *non* **cribrosa**, Goldfuss, 1827.

Syn. *Ceriopora cribrosa*, Goldfuss, 1827. Petref. Germ. vol. i. p. 36, pl. x. fig. 16.
non Lichenopora cribrosa, von Reuss, 1846. Verst. böhm. Kr. p. 64, pl. xiv. fig. 10; pl. xxiv. figs. 3–5.
Thalamopora ,, von Hagenow, 1846. In Geinitz, Gründr. Verst. vol. ii. p. 600.
,, ,, Simonowitsch, 1871. Bry. Essen.: Verh. nat. Ver. preuss. Rheinl. vol. xxviii. p. 27, pl. i. fig. 1.
non Polyphragma cribrosum, von Reuss, 1872. Bry. unt. Plän. vol. i.: Palæontogr. vol. xx. pt. i. p. 139, pl. xxxiii. figs. 8–10.

Distrib.—Cenomanian: Essen.

Aff.—The *C. cribrosa* of Goldfuss is probably a sponge; the *L. cribrosa* of von Reuss was made by him the type of a new genus of Foraminifera; the latter fossil occurs in the Lower Pläner of Bohemia and Saxony.

7. *non* **dilatata** (Römer), 1840.

Syn. *Palmipora dilatata*, Römer, 1840. Verst. nordd. Kr. p. 25, pl. v. fig. 30.
Ceriopora ,, Brauns, 1875. Senon. Quedl.: Zeit. Ges. Naturw. vol. xlvi. pp. 403–4.

Distrib.—Senonian: The 'Mergel' at Salzberg, near Quedlinburg.

Aff.—This species is not a Bryozoan, though it has been referred to *Ceriopora*.

8. ? **flabellula**, von Hagenow, 1846.

Syn. *Ceriopora flabellula*, von Hagenow, 1846. In Geinitz, Grundr. Verst. vol. ii. p. 596, pl. xxiii b, fig. 11.

Char.—A flat, flabellate zoarium; crowded, equal apertures.

Distrib.—Senonian—Campanian: Scania, Sweden.

9. **gillieroni** (de Loriol), 1869.

Syn. *Reptomulticava gillieroni*, de Loriol & Gilliéron, 1869. Mon. Urg. inf. Landeron: Mém. Soc. helvét. Sci. nat. vol. xxiii. p. 41, pl. iii. figs. 5–8.

Char.—A fungiform zoarium of which an average specimen has a stalk about 10 mm. in diameter and a cap 16 mm. in diameter, and height of 19 mm. The zoœcia are minute, and there are 80–100 apertures per sq. mm. Apertures circular to elliptical.

Distrib.—Lower Urgovian: Landeron, Neuchatel.

Aff.—Its nearest ally is *C. fungiformis*, from which it differs by having about four times as many apertures per sq. mm.

10. **incrustans**, von Reuss, 1846.

Syn. *Ceriopora incrustans*, von Reuss, 1846. Verst. böhm. Kr. p. 63, pl. xiv. fig. 8.

Char.—Zoarium small; zoœcia very small; apertures circular, barely visible to the naked eye, crowded. Walls on the surface slightly raised.

Distrib.—Cenomanian—Lower Pläner: Schillinge, near Bilin, Bohemia.

Aff.—A near ally of *C. collis* (d'Orb.), but with more crowded apertures.

11. ?**irregularis** (Michelin), 1847.

Syn. *Chætetes irregularis*, Michelin, 1847. Icon. Zooph. p. 306, pl. lxxiii. fig. 2.
Reptomulticava irregularis, d'Orbigny, 1854. Bry. Crét. p. 1038, pl. 791, figs. 15, 16.
,, ,, Pergens, 1890. Rev. p. 387.
? ,, ,, Gamble, 1896. Cat. Bry. Chatham, p. 4.
Polytrema marticensis, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 209.
Ceriocava irregularis, d'Orbigny, 1854. Bry. Crét. p. 1018, pl. 788, figs. 15, 16.
,, ,, Toucas, 1873. Terr. crét. Beausset: Mém. Soc. géol. France, ser. 2, vol. iv. pp. 41, 44.
Ceriopora (*Ceriocava*) *irregularis*, Pergens, 1890. Rev. p. 387.

Char.—Zoarium massive to dendroid; the upper surface is mammillated with numerous low, blunt elevations, which pass into thick, short, cylindrical branches. Apertures angular, very crowded, large.

Distrib.—Turonian: Martigues and l'étang de Caronte, Bouches-du-Rhone; Beausset and Mazaugues, Var; Soulage, Aude.

Aff.—This species varies from the lobed zoarium of d'Orbigny's *Reptomulticava irregularis* to the blunt digitate branches of *Chætetes irregularis* of Michelin, and to the dendroid form of *Ceriocava irregularis*, d'Orb. All these forms seem to be varieties of one species. D'Orbigny's figures of his *Reptomulticava irregularis* give evidence of a lamellar structure; but if the specimen be multilamellar, then it must be distinct from his *Ceriocava irregularis*.

12. **lamourouxi** (de Loriol), 1863.

Syn. *Ceriocava lamourouxi*, de Loriol, 1863. Inv. Néoc. moy. Mont Salève, p. 145, pl. xviii. fig. 5.

Char. — Zoarium dendroid; dichotomous, long branches (6 mm. diameter). Apertures very small and subangular.

Distrib.—Neocomian: La Varappe, Mont Salève.

Aff.—It differs from *C. ramulosa* (Mich.) by having smaller branches and much smaller apertures.

13. *non* **lobata** (Römer), 1839.

Syn. *Millepora lobata*, Römer, 1839. Verst. nordd. Ool., Nachtrag, p. 13, pl. xvii. fig. 12.

Distrib.—Neocomian: Schöppenstedt and Berklingen, Brunswick.

Aff.—This species is represented in the collection by three specimens (**D. 3649**) from the Hilsconglomerat of Berklingen, Saemann Coll. They show that the fossil does not belong to the Bryozoa.

14. *non* **mitra**, Goldfuss, 1827.

Syn. *Ceriopora mitra*, Goldfuss, 1827. Petref. Germ. pp. 39 and 85, pl. xxx. fig. 13.
,, ,, von Hagenow, 1846. In Geinitz, Grundr. Verst. p. 596.
Chrysaora ,, Römer, 1840. Verst. nordd. Kr. p. 24.
Spinopora ,, de Blainville, 1830. Dict. Sci. nat. vol. lx., Zooph. p. 380.
? ,, ,, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. pp. 27–8, figs. 17, 18.
Echinocava ,, Beissel, 1865. Bry. Aach. Kreid.: Nat. Verh. Holl. Maatsch. Wet. Haarlem, vol. xxiii. p. 11.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 226.
? *Pagrus* ,, Schlüter, 1870. Geogn.-Pal. Reise süd. Schweden: N. Jahrb. p. 940.

Distrib.—? Senonian—Campanian—Zone of *Belemnitella mucronata*: Ignaberga, Sweden.
Cenomanian: Essen.

Aff.—Probably a Hydrozoon.

15. ? *non* **nuciformis**, von Hagenow, 1839.

Syn. *Ceriopora nuciformis*, von Hagenow, 1839. Mon. Rüg.: N. Jahrb. 1839, p. 286, pl. v. fig. 9.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 225.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 47.

Char.—Indeterminable. Not a *Ceriopora*, as it is either heteroporous or cancellate.

DISTRIB.—Senonian—Campanian: Rügen.

AFF.—According to Hamm it is a Hydrozoon, a probable suggestion.

16. ? **pygmæa**, von Reuss, 1846.

SYN. *Ceriopora pygmæa*, von Reuss, 1846. Verst. böhm. Kr. p. 63, pl. xiv. fig. 9.
,, *nana*, von Reuss, 1874. Bry. ob. Plän.: Palæontogr. vol. xx. pt. ii. p. 136, pl. xxvi. figs. 3, 4.

AFF.—A young stage, generically indeterminable. Included by d'Orbigny in *Reptomulticava mamilla*, from which it appears very distinct (cf. p. 148). Zoarium very small, 3 mm. in length.

DISTRIB.—Cenomanian—Upper Pläner: Strehlen, Saxony.
Korycaner Schichten: Schillinge, near Bilin, Bohemia.

17. **quadripora**, Morren, 1829.

SYN. *Ceriopora quadripora*, Morren, 1829. Corall. foss. Belg.: Ann. Acc. Groning. 1828, p. 41, pl. xi.
,, ,, Bronn, 1849. Index Palæont., Enum. p. 144.

DISTRIB.—Groningen. Not Cretaceous.

18. ? **semiglobosa**, Römer, 1840.

SYN. *Ceriopora semiglobosa*, Römer, 1840. Verst. nordd. Kr. p. 23.

CHAR.—Small hemispherical zoarium with (according to Römer) large "triangular to hexagonal pores."

DISTRIB.—Senonian—Kreidemergel: Gehrden, Hannover.

19. ? **spongiosa**, Giebel, 1848.

SYN. *Ceriopora spongiosa*, Giebel, 1848. Polyp. Plänermergel Quedl.: Zeit. Zool. Zoot. Paläoz. vol. i. p. 17.

CHAR.—An irregular, tuberous, sponge-like, hollow mass; the 'tubuli' are thickly crowded and separated by only thin walls. Apertures irregular in shape, polygonal, or sometimes round.

DISTRIB.—Senonian: Salzburg, near Quedlinburg, Germany.

AFF.—The description given by Giebel leaves the generic position of this species quite uncertain.

20. **subnodosa**, Römer, 1839.

SYN. *Ceriopora subnodosa*, Römer, 1839. Verst. nordd. Ool., Nachtrag, p. 11, pl. xvii. fig. 19.
,, *subnodulosa*, Römer, 1840. Verst. nordd. Kr. p. 23.
Ceriocava ,, d'Orbigny, 1854. Bry. Crét. p. 1017.
? *Alveolites dichotoma*, Römer, 1839. *Op. cit.* p. 14, pl. xvii. fig. 15.

CHAR.—Zoarium of dichotomous, cylindrical branches, with small apertures which are represented as angular.

Distrib. — Neocomian — Hilsconglomerat: Schöppenstedt and Schandelahe, Brunswick.

Aff.—Römer in 1840 included his *Alveolites dichotoma* as probably a synonym of this species.

21. *non* **trigona**, Goldfuss, 1827.

Syn. *Ceriopora trigona*, Goldfuss, 1827. Petref. Germ. p. 37, pl. xi. fig. 6.
Chrysaora (*Ceriopora*) *trigona*, Römer, 1840. Verst. nordd. Kr. p. 24.
Filicava trigona, Simonowitsch, 1871. Bry. Essen.: Verh. nat. Ver. preuss. Rheinl. vol. xxviii. p. 54, pl. iii. fig. 3.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 226.

Distrib.— Senonian: Maastricht.
? Neocomian—Hilsconglomerat: near Essen (Römer).

Aff.—Probably a Hydrozoan.

22. **truncata**, Michelin, 1846.

Syn. *Ceriopora truncata*, Michelin, 1846. Icon. Zooph. p. 206, pl. li. fig. 7.

Char.—Zoarium dendroid, of short, thick, club-shaped branches, compressed when young. Apertures very small, irregularly distributed.

Distrib.—Cenomanian: Le Mans.

23. *non* **venosa**, Goldfuss, 1829.

Syn. *Ceriopora venosa*, Goldfuss, 1829. Petref. Germ. p. 86, pl. xxxi. fig. 2.
Spinopora venosa, Simonowitsch, 1871. Bry. Essen.: Verh. nat. Ver. preuss. Rheinl. vol. xxviii. p. 48, pl. iii. fig. 4.

Distrib.—Cenomanian: Essen.

Aff.—According to the section figured by Simonowitsch this species must be a Hydrozoon.

? NODICAVA, d'Orbigny, 1854.

[Bry. Crét. p. 1013.]

Nodicava pustulosa, the first of the four species referred by d'Orbigny to this genus, is included in the genus *Ceriocava* (B.M. Cat. Jur. Bry. 164). D'Orbigny described two Cretaceous species, the position of which seems to me indeterminable from the available information. M. Pergens rejects *Nodicava* as an "undulated *Melicertites*" (Rev. p. 386), in which case d'Orbigny's figure is very misleading.

1. **? digitata**, d'Orbigny, 1854.

Syn. *Nodicava digitata*, d'Orbigny, 1854. Bry. Crét. p. 1014, pl. 788, figs. 9, 10.
,, (? *Melicertites*) *digitata*, Pergens, 1890. Rev. p. 399.

Char.—Cylindrical branches, 3 mm. in diameter, with annular constrictions. Generic position indeterminable.

Distrib.—Neocomian: Sainte-Croix, Vaud.

2. **? muricata** (Goldfuss), 1829.

Syn. *Achilleum muricatum*, Goldfuss, 1829. Petref. Germ. p. 86, pl. xxxi. fig. 3.
Monticulipora muricata, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 184.
Nodicava ,, d'Orbigny, 1854. Bry. Crét. p. 1014.

Char.—Zoarium erect, with short, blunt branches. Blunt spines are scattered over the surface. Apertures regularly arranged in lines which cross at right angles. The apertures are sub-rectangular.

Distrib.—Cenomanian: Essen, Germany.

APPENDIX TO THE CERIOPORIDÆ.

GLOBULIPORA, Peron, 1893.

[Descr. invert. foss. terr. crét. sud Tunisie, pp. 349–52.]

Diagnosis.

Globular or hemispherical cellular bodies, ranging from 8 to 17 mm. in diameter. The internal structure not represented. In the specimen, described as best preserved, most of the zoœcia are nearly closed.

Type Species.

Globulipora africana, Peron, 1893. Upper Cretaceous: Southern Tunisia.

Affinities.

This genus is probably not a Bryozoon at all. It resembles *Conodictyum* from the French Argovian, which is sometimes included in the Foraminifera and sometimes, as by Sherborn,[1] referred to the Calcareous algæ; *Globulipora* is placed by Peron in the Cerioporidæ, "mais sous les réserves les plus expresses"; and of the three specimens that he figured the one which he described as the best preserved looks least like a Bryozoan.

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[1] C. D. Sherborn. "Index to the Genera and Species of the Foraminifera," 1893: Smiths. Misc. Coll., No. 856, p. 43.

UNREPRESENTED SPECIES.

africana, Peron, 1893.

Syn. *Globulipora africana*, Peron, 1893. Descr. invert. foss. terr. crét. sud Tunisie, p. 352, pl. xxx. figs. 22–6 *bis*.

Distrib.—Cenomanian and Turonian: Tunisia and Algeria; widely distributed.

CANALIPORA, von Hagenow, 1850.

[In Geinitz, Quadersandsteingebirge, p. 242.]

Synonyms.

Ceriopora, *pars*, von Reuss, 1846; von Hagenow, 1839; Marsson, 1887; Hennig, 1894.
Cabalipora, de Morgan, 1882.
Tuberculipora, Pergens & Meunier, 1887.
Petalopora, *pars*, von Zittel, 1881.[1]

Diagnosis.

Fossils with a massive zoarium, usually consisting of globular bodies or constricted stems. The zoœcia and apertures are very narrow in diameter and the apertures small.

The surface is marked by curved ridges, between which the apertures occur. The apertures are usually quincuncially arranged along curved intersecting lines.

Type Species.

Ceriopora articulata, von Hagenow, 1839. Mon. Rüg.: N. Jahrb. 1839, p. 284. Senonian—Campanian: Rügen.

Affinities.

This genus has been described under several names. It is characterized by its raised curved ridges which, according to von Hagenow,[2] continue within the zoarium, and by the exceptional smallness of the apertures.

The structure has unquestionable resemblances to some Hydrozoa, and the determination of the affinities of this genus requires full microscopic examination, for which the material in the Museum Collection is inadequate. The Museum possesses two small specimens, and as external examination of them does not show anything to necessitate their exclusion from the Bryozoa, the genus is provisionally left as an appendix to the Cerioporidæ; this conclusion is supported by the description and figures of *C. östrupi* from the Swedish Chalk given by Hennig, as the characters he delineates are those of Bryozoa rather than Hydrozoa.

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[1] K. von Zittel. Palaeozoologie, vol. i. pt. iv. p. 611.

[2] Von Hagenow. Bry. maastr. Kr. p. 50.

The species vary in the shape of the zoarium, the distribution of the apertures, and the development of the ridges.

Canalipora constricta (Römer), 1840.

SYNONYMY.

Ceriopora stellata, ? Goldfuss, von Hagenow, 1839. Mon. Rüg.: N. Jahrb. p. 285.
,, ,, von Hagenow, 1840. *Ibid.* pt. ii.: *ibid.* p. 647.
,, *tuberosa*, von Hagenow, 1840. *Ibid.* p. 639.
,, *constricta*, Römer, 1840. Verst. nordd. Kr. p. 23.
,, *strangulata*, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv. pt. i. p. 44, pl. iv. fig. 4.

DIAGNOSIS.

Cylindrical stems that are sometimes branched or give off blunt lobes. The stems are marked by irregular constrictions. Surface apparently smooth, so that the apertures appear to open flush with the surface instead of between ridges. Apertures quincuncial or in curved series, and in places irregular; angular, and rhombic to hexagonal. The apertures along the constrictions are smaller than on the rest of the stem.

Normal apertures about ·05 mm. in dia.

DISTRIBUTION.

Senonian—Campanian: Rügen.

AFFINITIES.

Marsson's and Römer's names are synonymous, as they were both founded on von Hagenow's *C. stellata*, Hag. (*non* Goldf.), which von Hagenow subsequently renamed *C. tuberosa*. Marsson renamed it *Ceriopora strangulata* on the ground that the name *C. tuberosa* had been preoccupied in 1839 by Römer, and gave as reference "Versteinerungen des norddeutschen Oolithgebirges, t. 14, fig. 17." But there is no such figure. The name *tuberosa* was given by Römer to two species, an *Alveolites tuberosa* (Verst. nordd. Oolithgeb., Nachtrag, p. 14, pl. xvii. fig. 9), which, in 1840 (Verst. nordd. Kreidegeb. p. 23), he transferred to *Ceriopora*; it is, however, not a Bryozoon. The other was *Heteropora tuberosa* (Verst. nordd. Oolithgeb. p. 12, pl. xvii. fig. 16), which is a *Heteropora*. *C. tuberosa* could therefore stand; but as Römer's *C. constricta* had been simultaneously founded on von Hagenow's account of *C. stellata*, its name would stand, and would in any case have preference of *C. strangulata.* The species is characterized by the distribution of the apertures being irregular in some parts of the zoarium and by the absence of the external ridges of *C. articulata.*

D. 1333. Two small fragments (on slide). Senonian — Campanian. Rügen. G. R. Vine Coll.

UNREPRESENTED SPECIES.

1. **articulata** (von Hagenow), 1839.

Syn. *Ceriopora articulata*, von Hagenow, 1839. Mon. Rüg.: N. Jahrb. p. 284.
,, ,, von Hagenow, 1846. In Geinitz, Grundr. Verst. vol. ii. p. 599, pl. xxiii B, fig. 16.
,, ,, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv. p. 43, pl. iv. fig. 3.
Canalipora ,, von Hagenow, 1850. In Geinitz, Quadersandsteingeb. p. 242.
,, ,, Kade, 1852. Los. Verst. Schanzenb. p. 32.

Char.—Zoarium of branching, cylindrical, constricted stems. The surface is marked by longitudinal ribs, between which are uniserial lines of small round pores.

Distrib.—Senonian—Campanian: Rügen.

Aff.—This species is characterized by its longitudinal ribs and lines of apertures.

2. **mammilla** (von Reuss), 1846.

Syn. *Ceriopora mammilla*, von Reuss, 1846. Verst. böhm. Kr. p. 63, pl. xiv. figs. 11, 12.
,, ,, Frič, 1869. Pal. böhm. Kreid.: Arch. naturw. Landesf. Böhm. vol. i. p. 197.
? ,, ,, Canu, 1900. Bry. Tours: C.R. Assoc. Av. Sci. 1899, p. 410.
? *Polytrema mamilla*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 279.
? *Reptomulticava* ,, (*non* Reuss), *pars*, d'Orbigny, 1854. Bry. Crét. p. 1041, pl. 793, figs. 3, 4.
,, ,, Pergens, 1890. Rev. p. 388.
? *Ceriopora* (*Reptomulticava*) *mammilla*, Keeping, 1883. Foss. Neoc. Upware, p. 139.
,, *substellata, pars*, von Reuss, 1874. Bry. ob. Plän.: Palæontogr. vol. xx. pt. ii. p. 136.

Char.—Zoarium small and sessile, with a well-marked constriction above the base. It becomes branched by giving off lobate buds. The surface is covered with curved ribs, which cross the stem obliquely. The apertures open in the furrows between the ribs.

Distrib.[1]—Cenomanian—Lower Plänerkalk: Schillinge, near Bilin, Bohemia.

Remarks.—This species has been confused by the action of von Reuss in 1874, who then reduced it to a synonym of *Ceriopora substellata*; but in spite of the weight to be attached to an author's opinion of one of his own species, the justice of this decision seems to me most improbable. The specimen figured by von Reuss in 1846 has the characters of a typical *Canalipora*, and it is difficult to understand how any specimen of the species *substellata* could be misrepresented into the aspect given by von Reuss's figure of 1846. The specimens figured by d'Orbigny from the Senonian seem to me distinct; the zoœcia are much larger than in *C. mammilla*; the Senonian forms are more allied to *C. pygmea* of von Reuss, which d'Orbigny includes as a synonym of *C. mammilla*; but the two forms seem clearly separated by the much larger size of the apertures in *C. pygmea*. The *R. mamilla* of d'Orbigny seems to me most probably (*vide* p. 148) a form of *Reptomulticava digitalis* (d'Orb.); but the question may be left doubtful, as Pergens says the type is a worn specimen of a species belonging to some family other than Pergens' Cerioporidæ.

3. **östrupi** (Pergens & Meunier), 1887.

Syn. *Tuberculipora östrupi*, Pergens & Meunier, 1887. Bry. gar. Faxe: Ann. Soc. malac. Belg. vol. xxi., Mém. p. 220, pl. x. fig. 5.
Ceriopora ,, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 37, pl. ii. fig. 40, and fig. 22, p. 37.

Char.—Zoarium branched; stems deeply constricted into a series of ovoid to piriform bodies. The stem is as much as 1·8 mm. in thickness across the internodes and from ·6 to ·8 mm. in diameter at the constrictions. The surface is crossed by curved, oblique ribs and lines of apertures. Apertures about ·07 mm. in diameter.

Distrib.—Danian: Faxoe, Zeeland, Denmark.
Senonian—Campanian: Stevn's Klint, north of the town of Lilledalen, Faxoe, Denmark.
Zone of *Belemnitella mucronata*: Qvarnby, Sweden.

4. **striato-punctata** (von Hagenow), 1839.

Syn. *Ceriopora striato-punctata*, von Hagenow, 1839. Mon. Rüg.: N. Jahrb. p. 283.
,, ,, von Hagenow, 1846. In Geinitz, Grundr. Verst. vol. ii. p. 599.

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[1] The species is recorded by d'Orbigny and Canu from the Senonian, and by Keeping from the Aptian of Brickhill, Bedfordshire, and Farringdon, Berkshire, but in both cases the record is very doubtful.

Escharites (C.) striato-punctata,		Römer, 1840. Verst. nordd. Kr. p. 17.
Canalipora	,,	von Hagenow, 1850. In Geinitz, Quadersandsteingeb. p. 242.
,,	,,	Schlüter, 1870. Geogn.-pal. Reise süd. Schwed.: N. Jahrb. p. 940.
Cabalipora	,,	de Morgan, 1882. Terr. crét. Scand.: Mém. Soc. géol. France, ser. 3, vol. ii. p. 39.

Char.—The stems are compressed and elliptical in cross-section. They are seldom branched. Constrictions deep. Ribs and furrows longitudinal.

Distrib.—Senonian—Campanian: Rügen; Balsberg and Oretorp, Southern Sweden.

Aff.—It is allied by its longitudinal ribbing to *C. articulata*. The most marked distinction is that in *C. striato-punctata* the stems are very flat.

HETEROPORIDÆ, Pergens & Meunier, 1887.

Synonyms.

Crescisidæ, d'Orbigny, 1854.
Cerioporidæ, *pars*, Busk, 1859; Hamm, 1881; *pars*, Ulrich, 1900.
Heteroporidæ, Pergens & Meunier, 1887.
Entalophoridæ, *pars*, Pergens, 1890.
Heterotrypidæ, Gregory, 1896.

Diagnosis.

Trepostomata in which the zooecia are simple, prismatic, or cylindrical, and grow in dense masses or thick branches. Mesopores present, and distributed more or less evenly throughout the whole zoarium. Diaphragms numerous and horizontal. Neither cystiphragms nor interzooecial vesicles present.

In the Catalogue of Jurassic Bryozoa (1896, p. 201) the Jurassic species of *Heteropora* were included in the Palæozoic family the Heterotrypidæ of Ulrich. This step was taken as I was unable to recognize any positive character of family value by which these Jurassic species could be separated from the similar Palæozoic species. I am still unable to point to any character by which, if one of the Mesozoic *Heteroporæ* were found associated with Palæozoic Heterotrypidæ, it could be separated from them.

The difference in geological age is, however, important, for the Palæozoic *Heterotrypæ* become extinct and are succeeded by the Jurassic *Heteroporæ* only after a great interval in time; for *Heterotrypa* is commonest in the Ordovician, though it lives on into the Devonian. The long separation between *Heterotrypa* and its successors may be due in part to our ignorance of the Bryozoa from the Trias, but the gap is so great that as a matter of convenience it may be advisable to separate the Mesozoic forms as a distinct family.

Among the names applied to this family the Crescisidæ of d'Orbigny has long priority. That family was founded in 1854[1] for eleven genera, of which *Omniretepora* included a Silurian species (*Hornera crassa*, Lonsd.[2]) from the Wenlock Limestone; but the other ten genera are a homogeneous group, and may be included in the two genera *Heteropora* and *Multicrescis*.

Five years later Busk[3] placed *Heteropora* with six other genera, including such varied fossils as *Neuropora*, *Alveolaria*, *Spiropora*, *Fungella*, and *Stellipora*, in a family, the Cerioporidæ. This artificial group has no claim to recognition.

In later years *Heteropora* was assigned a very different position, owing to the *Petaloporæ*, which had been included in it, being adopted as the type of the genus. Thus Marsson[4] used *Heteropora* for three species of *Petalopora*, and therefore separated the genus far from the *Ceriopora* group and included it in the Entalophoridæ. Pergens & Meunier[5] had just before founded a family Heteroporidæ, and referred to it *Heteropora polytaxis* (Hag.) and *Heteropora substellata* (d'Orb.); but, unfortunately, M. Pergens subsequently followed Marsson, and described[6] *Heteropora* as only "formes *d'Entalophora*, chez lesquelles s'est effectué un grand dépôt de calcaire, avec de fortes cavités intersquelettiques." He, however, included in *Heteropora* such species as *arborea*, K. & D., *variabilis*, d'Orb., *michelini*, d'Orb., and *constanti*, which do not answer to this description, as well as species of *Claviclausa*.

Hamm,[7] on the other hand, had taken the massive species of *Heteropora* as the type and retained the genus in his family Cerioporidea.

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[1] Bry. Crét. p. 1063.

[2] In Murchison. Silurian System, pl. xv. fig. 13.

[3] G. Busk. Crag Polyzoa, 1859, p. 91.

[4] Th. Marsson. Bry. Rügen: Pal. Abh. 1887, vol. iv. pp. 25–6.

[5] E. Pergens & A. Meunier. Bry. gar. Faxe: Ann. Soc. malac. Belg. 1887, vol. xxi. (1886), p. 223.

[6] E. Pergens. Rev. 1890, p. 357.

[7] H. Hamm. Bry. mastr. Ob.-Sen. i., Cycl. 1881, p. 34.

That Hamm was right in his selection seems to me unquestionable. The reasons for accepting *H. cryptopora* (Hag.) as the type of *Heteropora* are stated on p. 188. That species has a massive zoarium, and is quite distinct from those with the finely branched zoarium and cancellate tissue of *Petalopora*.

The name Heteroporidæ is, however, the most convenient, as the genus *Crescis* has been merged; for of the two species which d'Orbigny assigned to it, the first, *C. dumetosa* (Lamx.), is merged in *Heteropora conifera* (Lamx.), and the second, *C. complicata*, is practically undescribed and unknown.[1]

FUNGELLA, von Hagenow, 1851.

[Bry. maastr. Kr. p. 37.]

SYNONYMS.

Fungella, pars, von Hagenow, 1851; Winkler, 1864; Ubaghs, 1879; Pergens & Meunier, 1887.

Fasciculipora, pars, d'Orbigny, 1850; Hamm, 1881; Pergens, 1890; Bucaille, 1890; Hennig, 1894; Ulrich, 1900.

Corymbosa, pars, d'Orbigny, 1853.

DIAGNOSIS.

Heteroporidæ with a simple capitate zoarium. The peduncle is narrow. The head usually club-shaped.

Apertures irregularly scattered over the head of the zoarium.

Mesopores numerous, irregularly arranged.

TYPE SPECIES.

Fungella dujardini, von Hagenow, 1851. (For selection of this species as the type, see note, p. 46, where the family is referred to as Crescisidæ.)

AFFINITIES.

This genus is a *Heteropora* with a capitate zoarium. The Heteroporous structure of the zoarium is not manifest from von Hagenow's original figures; but that the zoarium is dimorphic is clearly shown by the specimen figured on Pl. VII. Fig. 2, and the section Fig. 46, p. 183.

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[1] Gregory. B.M. Cat. Jur. Bry. 1896, pp. 203, 210.

1. **Fungella dujardini,** von Hagenow, 1851.

SYNONYMY.

Fungella	*dujardini,*	von Hagenow, 1851. Bry. maastr. Kr. p. 38, pl. iii. fig. 8.
,,	,,	Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 214.
,,	,,	Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 222.
,,	,,	Pergens & Meunier, 1887. Bry. gar. Faxe: Ann. Soc. malac. Belg. vol. xxi., Mém. p. 221.
Corymbosa	,,	d'Orbigny, 1853. Bry. Crét. p. 690.
Fasciculipora	,,	Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 35.
,,	,,	Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 29, pl. ii. fig. 44.
,,	,,	Pergens, 1890. Rev. p. 377.
,,	*clavata,*	d'Orbigny, 1850. Prod. Pal. vol. ii. p. 268.
,,	,,	Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 512.
Corymbosa	,,	d'Orbigny, 1853. Bry. Crét. p. 692, pl. 744, figs. 13–15.

DIAGNOSIS.

Zoarium small, clavate; usually attached by the expanded base of the stem. The apertures open on the upper surface, which is well rounded and may be hemispherical. A well-defined line separates the upper surface from the stem, in which all the apertures have been reduced to pores by addition of epizoarial material. The stem passes gradually upward from a narrow diameter near the base into the head.

Apertures irregularly arranged and separated by a single or in places by a double line of mesopores.

DIMENSIONS.	Von Hagenow's type.	D. 3292.
	mm.	mm.
Height of zoarium	over 7·5 ...	10
Diameter of head	5 ...	7
Minimum diameter of stem ...	1·2 ...	2
Length of stem from rim to base ...	— ...	5·5
Diameter of apertures	·1 ...	·2
Diameter of mesopores	— ...	·08–·12

DISTRIBUTION.

Senonian—Maastrichtian: Maastricht; St. Pierre.
Campanian—Zone of *Belemnitella mucronata* (beds with *Actinocamax mamillatus*): Balsberg and Ö. Karup, Sweden.

FIGURES.

Pl. VII. Fig. 2*a*. A zoarium from the side; × 2 dia. Fig. 2*b*, part of the upper surface of the same; × 10 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3292.**

Fig. 46. Part of a thin section from the lower part of the head of a specimen, showing the secondary calcification on the outer wall and the closing of a few zoœcia in the middle of the zoarium ; × 10 dia. **D. 3292.**

AFFINITIES.

This species is taken as the type of the genus for reasons stated on p. 46.

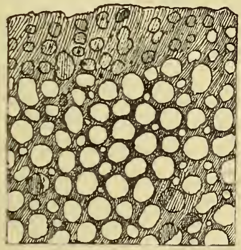

FIG. 46.—*Fungella dujardini.* Horizontal section ; × 10. **D. 3292.**

LIST OF SPECIMENS.

D. 3292. Six zoaria (in tube), and one thin section cut from one of them. One specimen is figured on Pl. VII. Fig. 2*a*, and shows the heteroporous structure. A thin section from another specimen is shown in Fig. 46. In three of the specimens the dimorphic nature of the zoœcia is obscured by the secondary thickening of the walls. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 11,825. A specimen incrusted by a nullipore. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3290. A zoarium 8 mm. high ; head 5 mm. in diameter; stalk 2 mm. in diameter ; and covered with thick epizoarium. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3291. Two normal zoaria (on slide) ; one shows clearly that the small pores on the stalk are the remains of the apertures of zoœcia, nearly closed by the thickening of the walls. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3602. Twelve zoaria (in tube). Labelled on a Van Breda Coll. label, "*Manon capitatum*, Goldf." Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 6399. A fragment (on slide). Maastrichter Kalk. St. Pierre. Presented by Miss Busk.

UNREPRESENTED SPECIES.

1. fungosa (Hennig), 1894.

SYN. *Fasciculipora fungosa*, Hennig, 1894. Bry. Sver. Krit. ii., Cycl. : Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 29, pl. i. figs. 19, 20.

CHAR.—Zoarium simple, subclavate; laterally compressed. A few apertures on the upper part of the stem, but most of them situated on the upper surface. Apertures ·2 mm. diameter, separated only by single lines of mesopores.

DISTRIB.—Senonian—Campanian—Zone of *Belemnitella mucronata*: beds with *Actinocamax mamillatus*, Balsberg, Sweden.

2. ? hincksi, Pergens, 1894.

SYN. *Fasciculipora ? hincksi*, Pergens, 1894. Nouv. Bry. Crét. Limb.: Bull. Soc. belge Géol. vol. vii., Mém. p. 175, pl. ix. fig. 6 (not 3 as misprinted).

CHAR.—Simple, erect zoarium, which is somewhat club-shaped, as it consists of a short stalk and expanded head. The zoarium is 2 to 2·5 mm. in diameter and about 4 mm. high. The stem is marked by a vertical series of small round pores. On part of the head some of the apertures are large, and are surrounded by a ring of apparent mesopores; but in places the apertures are nearly all of the same size. Pergens remarks: "Je ne crois pas que ce soient des cavités intersquelettiques comme chez les *Heteropora*, mais leurs dimensions extrêmement variables les font regarder comme étant de même nature que celles des Cerioporidæ, c'est-à-dire comme des zoécies jeunes en voie d'accroissement."

DISTRIB.—Senonian—Maastrichtian: Petit-Lanaye, near Maastricht.

AFF.—The affinities are doubtful owing to the doubt as to the presence of mesopores. Otherwise the species seems nearly allied to *Fungella dujardini*, Hag.

HETEROPORA, de Blainville, 1830.

[Zooph.: Dict. Sci. nat. vol. lx. p. 381.]

SYNONYMY.

Millepora, *pars*, Lamouroux, 1821; Fleming, 1828; Goldfuss, 1827.
Ceriopora, ,, Goldfuss, 1827; Michelin, 1846; von Hagenow, 1851; etc.
Spiropora, ,, Defrance, 1827.
Cricopora, ,, de Blainville, 1830 and 1834.
Monticulipora, *pars*, d'Orbigny, 1849.
Polytrema, d'Orbigny, 1849.
Crescis, d'Orbigny, 1854.
Nodicrescis, d'Orbigny, 1854.
non Heteropora, Marsson, 1887.
Heteropora, *pars*, Pergens, 1890; Hennig, 1894; Ulrich, 1900.

DIAGNOSIS.

Heteroporidæ with a massive or branching zoarium composed of long zoœcia, and not built up of successive distinct layers.
Apertures and mesopores irregularly arranged.

TYPE SPECIES.

Heteropora cryptopora (Goldfuss), 1827. Petref. Germ. vol. i. p. 33, pl. x. figs. 3*a–d*; de Blainville, Dict. Sci. nat. 1830, vol. lx. p. 382.

AFFINITIES.

De Blainville[1] founded the genus *Heteropora* on three species that had been founded by Goldfuss, viz., *Ceriopora cryptopora*, *C. anomalopora*, and *C. dichotoma*, all three from the limestone of Maastricht; and de Blainville stated that his new genus "se distingue essentiellement par l'existence de deux sortes de cellules ou de pores, les unes deux ou trois fois plus grandes que les autres." Of these three species *H. cryptopora* was mentioned first, and of the others the *C. anomalopora*, Goldf., is a *Ditaxia* and *C. dichotoma*, Goldf., is a *Sparsicavea*.

It is necessary to exclude from *Heteropora* the numerous species that have been referred to this genus, but belong to *Petalopora* and *Sparsicavea*. The *Heteropora* of Marsson is *Sparsicavea*.

1. **Heteropora cryptopora** (Goldfuss), 1827.

SYNONYMY.

Ceriopora cryptopora, *pars*, Goldfuss, 1827. Petref. Germ. vol. i. p. 33, pl. x. figs. 3*a–d*.
,, ,, Morren, 1829. Corall. foss. Belg.: Ann. Acc. Groning. 1828, p. 38.
,, ,, Klöden, 1834. Verst. Brandenburg, p. 262.
? ,, ,, von Hagenow, 1839. Mon. Rüg.: N. Jahrb. p. 282.
,, ,, Cornuel, 1841. Terr. crét. Vassy: Mém. Soc. géol. France, vol. iv. No. iv. p. 257.
,, ,, Leymerie, 1842. Terr. crét. Aube, pt. ii.: *ibid.* vol. v. No. i. p. 22.
,, ,, von Hagenow, 1851. Bry. maastr. Kr. p. 53, pl. v. fig. 6.
,, ,, ? Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 36.
? ,, ,, Canu, 1900. Bry. Tours: C.R. Assoc. franç. Av. Sci. 1899, p. 410.
Heteropora ,, *pars*, de Blainville, 1830. Zooph.: Dict. Sci. nat. vol. lx. p. 382.
,, ,, *pars*, de Blainville, 1834. Man. Act. p. 417, pl. lxx. fig. 4.
non ,, ,, Michelin, 1841. Icon. Zooph. p. 3, pl. i. fig. 2.
,, ,, Portlock, 1843. Geol. Londonderry, p. 344.
,, ,, d'Orbigny, 1854. Bry. Crét. p. 1070.

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[1] De Blainville. Zooph.: Dict. Sci. nat. vol. lx. p. 382.

Heteropora cryptopora,	Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 209.
,, ,,	Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 226.
,, ,,	Downes, 1882. Blackdown Beds: Quart. Journ. Geol. Soc. vol. xxxviii. p. 86.
,, *crassa*,	*pars*, von Hagenow, 1851. Bry. maastr. Kr. p. 46, pl. v. figs. 12*a*, *b*, *non* fig. 13.
,, ,,	*pars*, Kade, 1852. Los. Verst. Schanzenb. p. 32.
,, ,,	*pars*, d'Orbigny, 1854. Bry. Crét. p. 1070.
,, ,,	*pars*, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 226.
,, ,,	Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift. vol. xxx., Acta Physiogr. No. viii. pp. 21, 22, pl. i. fig. 18; figs. 9, 10, p. 21; and fig. 11, p. 22.
,, *tenera*,	von Hagenow, 1851. Bry. maastr. Kr. p. 48, pl. v. fig. 14.
,, ,,	d'Orbigny, 1854. Bry. Crét. p. 1070.
,, ,,	Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 226.
,, ,,	Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 36.
,, ,,	Vine, 1884. 4th Report: Rep. Brit. Assoc. 1883, p. 172.
,, ,,	Ubaghs, 1888. C.R. Excursion: Bull. Soc. belge Géol. vol. i., Mém. p. 233.
Millepora compressa,	Goldfuss, 1827. Petref. Germ. p. 21, pl. viii. fig. 3.
,, ,,	Giebel, 1848. Polyp. Plänermergel Quedl.: Zeit. Zool. Zoot. Paläoz. vol. i. p. 10.

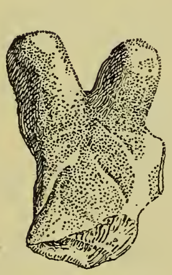

Fig. 47.—*Heteropora cryptopora.* A zoarium; × 2. **D. 6366.**

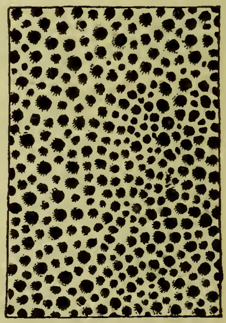

Fig. 48.—*Heteropora cryptopora.* Surface of the zoarium; × $13\frac{1}{3}$. **D. 6366.**

Diagnosis.

Zoarium dendroid, with cylindrical dichotomous branches, which are of medium thickness, ranging up to 12·5 mm. in diameter. The branches have tapering ends.

Zoœcia large, with the apertures widely spaced.

Mesopores very numerous, the apertures being separated by one or two lines of them.

DIMENSIONS.

	Goldfuss, pl. x. fig. 3*a*. Type of *cryptopora*, *fide*, Hag.	Goldfuss, pl. x. fig. 3*c*. *tenera*, Hag.	*crassa*, Hag.	Specimen from Derry, *fide* Portlock.	B.M. D. 6366.
	mm.	mm.	mm.	mm.	mm.
Height of zoarium	15	17	11	12·5–25	15
Diameter of stem	3–4	4·5	4	12·5	4–7
,, apertures	·04–·05	·05	·16[1]	·04?	·1
,, mesopores	·025	·025	·05	⅕ dia. of the apertures	·03–·04
No. of apertures per sq. mm.	about 35	about 30	about 10[1]	—	about 25

DISTRIBUTION.

BRITISH:

? Chloritic chalk: Tamlaght, co. Derry, Ireland (*fide* Portlock).
? Cenomanian: Blackdown, Devon (*fide* Downes).

FOREIGN:

Senonian—Maastrichtian: Maastricht and Fauquemont; Calcaire de Kunraed (*fide* Ubaghs).
Campanian: Rügen. Zone of *Belemnitella mucronata*: Stafversvad, Hemmingslycke, and Mörby; beds with *Actinocamax mamillatus*, Ignaberga, Balsberg, V. Olinge, Ifö, and Barnakällegrottan, Sweden.
? Coniacian: Tours (*fide* Canu).
? Albian: Les Croûtes, Dép. de l'Aube (*fide* Leymerie).
? Hauterivian: Vassy (*fide* Cornuel).

FIGURES.

Fig. 47, p. 186. A zoarium from the side; × 2 dia. Maastrichter Kalk: Fauquemont. Busk Coll. **D. 6366.**

Fig. 48, p. 186. Part of the surface of the same specimen; × 13⅓ dia. Maastrichter Kalk: Fauquemont. Busk Coll. **D. 6366.**

Fig. 49, p. 188. Part of a vertical section through the end of a branch of another specimen; × 10 dia. Maastrichter Kalk: Fauquemont. Busk Coll. **D. 6366 b.**

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[1] These figures taken from von Hagenow's figure may be too great; von Hagenow's fig. 12*d* is said to be magnified only 15 diameters, but this may be an error. Otherwise the apertures are twice as large as in *H. tenera*.

AFFINITIES.

The first difficulty with this species is due to the fact that Goldfuss gave four figures (pl. x. figs. 3*a–d*), and also identified with it a specimen which von Hagenow has used as the type of his *Ceriopora schweiggeri.* Von Hagenow has described and refigured Goldfuss' specimens; but, unfortunately, he transfers the species *cryptopora* to *Ceriopora*, and renames the *Heteropora.* According to his determinations the five specimens of Goldfuss may be renamed as follows:—

Goldfuss, pl. x. fig. 3*a* = *Ceriopora cryptopora*, Hag., pl. v. fig. 6, p. 53.
3*b* = specimen apparently lost (Hag. p. 53); but according to von Hagenow it probably belongs to his *H. crassa.*
3*c* = *Heteropora tenera*, Hag., p. 48 (? pl. v. fig. 14).
3*d* = *Heteropora crassa*, Hag., p. 46.
not figd. = *Heteropora schweiggeri*, Hag., pl. v. fig. 1.

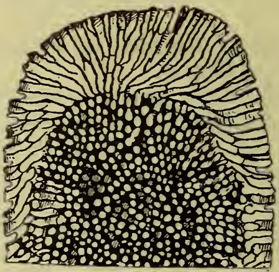

FIG. 49.—*Heteropora cryptopora.* Vertical section ; × 10. **D. 6366b.**

The difficulty in this arrangement is the inclusion of *cryptopora*, the type species of *Heteropora*, in *Ceriopora.* The evidence in support of this step seems very doubtful, for von Hagenow's figure of Goldfuss' type-specimen (pl. v. fig. 6*c*) suggests that it is a *Heteropora.* It is true that von Hagenow says of his section (fig. 6*b*) that it has "mehrere Hundert gleichgrosser, feiner Poren"; but his figure appears to indicate a small number of mesopores, and such basal sections as he figures often show hardly any mesopores. Von Hagenow remarks, moreover (p. 53), that "the pores vary a little in largeness," adding, however, that they are not divided into the large and the small. He stated that he knew only the one basal fragment, which was Goldfuss' type; and von Hagenow's figure shows on it what I should regard as definite mesopores. The specimen appears, therefore, to be a true *Heteropora*, in which the characters are badly shown, as the specimen is an old, partly calcified base. A strong argument for including the species in *Heteropora* is given by *Heteropora tenera*, Hag., which is a typical *Heteropora* (see von Hagenow, pl. v. fig. 14*b*); and von Hagenow remarks on his explanation of his plate v. that it is "vielleicht identisch mit *Ceriopora cryptopora*."

It seems to me simplest to restore Goldfuss' conception of this species, interpreting his fig. 3*a* by von Hagenow's figure of the same specimen (pl. v. fig. 6*c*), and including *H. tenera*, Hag., and *H. crassa*, Hag., *pars* (i.e. pl. v. fig. 12, *non* fig. 13), as synonyms. *H. tenera* is a young branch, *H. crassa* a thicker dichotomous branch, and *H. cryptopora*, the type (Goldfuss, pl. x. fig. 3*a*, and Hagenow, pl. v. fig. 6), is the base of a large zoarium.

The *Multicrescis laxata* of d'Orbigny[1] resembles this species in the biserial pores around the apertures and shape of the branches, but that Bryozoan appears to be a *Sparsicavea dichotoma* (*vide* p. 304).

Goldfuss' species *M. compressa* appears to be only a zoarium with slightly compressed branches.

The Museum specimen, **D. 6366**, agrees precisely in zoarial characters with *cryptopora*, and, as shown by the magnified figure of the surface (Fig. 48, p. 186), it is a true *Heteropora*.

LIST OF SPECIMENS.

D. 6366. Zoaria of var. *crassa*, Hag. Maastrichter Kalk. Fauquemont. Busk Coll. Presented by Miss Busk. Figs. 47, 48, p. 186; Fig. 49, p. 188.

60,150. Five specimens labelled *Ceriopora cryptopora*. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3352. A worn stem, showing the heteroporous character but imperfectly. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3470. A zoarium 30 mm. long × 20 mm. wide; in worn areas the structure appears that of *Ceriopora*; but on the growing edges, where the structure is well shown, it is decidedly that of *Heteropora*; the mesopores occur in single series round the apertures. Maastrichter Kalk. Maastricht. Van Breda Coll.

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[1] Bry. Crét. p. 1077, pl. 800, figs. 10, 11; the type locality is the Maastrichtian at Saint-Colombe, Manche.

D. 6340. Two stems of the var. *tenera* (on slide). Maastrichter Kalk. St. Pierre, Maastricht. Busk Coll. Presented by Miss Busk.

D. 6364. A zoarium, 12 mm. high; bilobed above, where it is 10 mm. wide. The smallest part of the stem is 6 mm. wide, except at the base, which is 5 mm. wide. (On slide.) The apertures are mostly crowded, but in places are scattered, as in von Hagenow's figure (Bry. maastr. Kr. pl. v. fig. 6*c*). Labelled *Ceriopora cryptopora* by Busk. Maastrichter Kalk. Fauquemont (?). Busk Coll. Presented by Miss Busk.

D. 6365. A nodular zoarium (on slide). Maastrichter Kalk. Fauquemont. Labelled *Ceriopora cryptopora*. Characters similar to **D. 6364.** Busk Coll. Presented by Miss Busk.

2. **Heteropora keepingi**, Gregory, 1909.

SYNONYMY.

non Ceriopora michelini, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 143.
Multicrescis ,, *pars*, d'Orbigny, 1854. Bry. Crét. p. 1075, pl. 799, figs. 14, 15.
,, ,, Etheridge & Newton, 1878. Cat. Cret. Foss. Mus. Pract. Geol. p. 7.
Heteropora (*Multicrescis*) *michelini*, *pars*, Keeping, 1883. Foss. Neoc. Upware, p. 141.
,, ,, *michelini*, Pergens, 1890. Rev. p. 373.
,, *keepingi*, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 64.

DIAGNOSIS.

Zoarium tufted, rising from a thick base, giving off above thick, finger-shaped, simple branches, or knobby branches, which may divide irregularly; branches end bluntly.

Mesopores uniserial, or sometimes biserial.

DIMENSIONS.

	B.M. D. 7292.	B. 118.
	mm.	mm.
Height of zoarium	50 ...	23
Thickness of branches	9 ...	5–8
Diameter of apertures	·15 ...	·15
Distance between centres of apertures ...	·3–·4 ...	·3–·4
Number of apertures per sq. mm. ...	9–10 ...	12

DISTRIBUTION.

BRITISH:

Lower Greensand: Brickhill, Upware? (*fide* Keeping); Coxwell and Farringdon, Berkshire; ? Isle of Wight.

FOREIGN:

Albian: Grandpré, Ardennes.

FIGURES.

Pl. V. Fig. 7*a*. A zoarium from the side; nat. size. Fig. 7*b*, part of the surface of the same specimen; × 10 dia. Lower Greensand: Farringdon. Cunnington Coll. **D. 7292.**

Pl. V. Fig. 8. A zoarium with short thick branches; nat. size. Lower Greensand: Loc.? South of England. Old Coll. **B. 118.**

Fig. 50. A section, × 13 dia., across part of the zoarium shown on Pl. V. Fig. 8. Lower Greensand: Loc.? South of England. Old Coll. **B. 118.**

AFFINITIES.

The unfortunate necessity for the removal of the name *michelini* to the species for which von Reuss's name of *coalescens* was more appropriate, requires the introduction of a new name for the specimens that d'Orbigny figured in 1854 as *Multicrescis michelini*. This species has thick, irregular, massive branches, which differ markedly from the often anastomosing branches of the zoarium, which was used by d'Orbigny as the type of his *Ceriopora michelini*.

There is no evidence for the multilamellar structure of the zoarium, so it should remain in *Heteropora*.

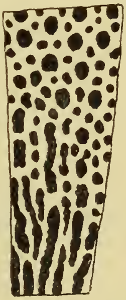

FIG. 50.—*Heteropora keepingi*. Section; × 13. **B. 118.**

LIST OF SPECIMENS.

B. 118. A zoarium with short thick branches and thin section cut from it. Lower Greensand. Loc.? Judging from the nature of the matrix (which is a dark-green, coarse, glauconitic sandstone) it probably came from the Isle of Wight. Figd. Pl. V. Fig. 8, and Fig. 50.

D. 7292. A long branched zoarium. Lower Greensand. Farringdon. Cunnington Coll. Figd. Pl. V. Fig. 7.

D. 7169. Four zoaria. Lower Greensand. Coxwell, near Farringdon. F. Ellis Coll. Received in exchange with R. F. Damon, 1901.

3. **Heteropora clavata,** Kade, 1852.

SYNONYMY.

Heteropora clavata, Kade, 1852. Los. Verst. Schanzenb. p. 32.
,, ,, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 64.

DIAGNOSIS.

Zoarium piriform, with a short stem, which expands regularly upward into a pear-shaped mass. Transverse section irregularly elliptical; flattened on the side. Most of the surface is smooth, but the type-specimen is irregularly pitted.

Zoœcia large, irregularly scattered. Mesopores large, a circle of five to seven around each aperture; and the circles of mesopores are confluent, so that but one mesopore or line of mesopores occurs between adjacent zoœcia.

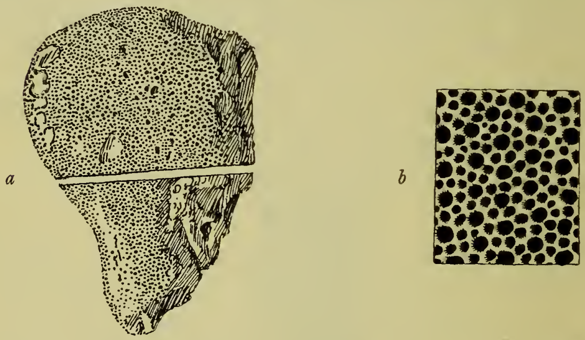

FIG. 51.—*Heteropora clavata.* *a.* Zoarium; × 2. *b.* Part of the surface; × 10. **D. 7294.**

DIMENSIONS.

	mm.
Height of zoarium	22
Diameter of zoarium	18 × 10
Diameter at the base	5 × 4
Diameter of apertures	·2
Diameter of mesopores	·06–·1

DISTRIBUTION.

BRITISH:

Lower Greensand: Farringdon (Workhouse Pit), Berkshire.

FOREIGN:

Remanié in Drift: Schanzenberg, near Meseritz.

FIGURES.

Fig. 51*a*, p. 192. The zoarium from the side; × 2 dia. Fig. 51*b*, part of the surface; × 10 dia. Lower Greensand: Farringdon. Caleb Evans Coll. **D. 7294.**

AFFINITIES.

This species was founded by Kade on a drift specimen, of which the horizon is unknown, but is probably Lower Cretaceous. His description is inadequate. He states that it "resembles the form of *Ceriopora clavata*, Goldf., through its club-shaped expansion, but the larger pores are regularly surrounded by the smaller."

These characters, so far as they go, agree with those of a specimen from Farringdon, illustrated by Figs. 51*a*, *b*. A transverse section across this specimen shows that it has a massive centre composed of long zoœcia which reach to the surface of the zoarium; the structure is not multilamellar, and the species is therefore a *Heteropora* and not a *Multicrescis*.

Kade's name might well be ignored as a *nomen nudum*, and the Farringdon specimen may be accepted as the type of *Heteropora clavata*.

D. 7294. A zoarium with a narrow base; it is 18 mm. in diameter at the top, and the stalk is 7 mm. in diameter. Lower Greensand. Workhouse Pit, Farringdon. Caleb Evans Coll. Purchased of E. Westlake, 1887. Figs. 51*a*, *b*, p. 192.

4. Heteropora michelini (d'Orbigny), 1850.

SYNONYMY.

Heteropora cryptopora (*non* Goldf.), Michelin, 1841. Icon. Zooph. p. 3, pl. i. fig. 2.
Ceriopora michelini, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 143.
non Multicrescis michelini, d'Orbigny, 1854. Bry. Crét. p. 1075, pl. 799, figs. 14, 15.
,, *Heteropora* (*Multicrescis*) *michelini*, Keeping, 1883. Foss. Neoc. Upware, p. 141.
,, ,, ,, ,, *pars*, Pergens, 1890. Rev. p. 373.
,, *coalescens*, von Reuss, 1872. Bry. unt. Quad.: Palæontogr. vol. xx. pt. i. p. 131, pl. xxxii. figs. 10–12.
? ,, ,, Keeping, 1883. Foss. Neoc. Upware, p. 141.

DIAGNOSIS.

Zoarium often somewhat flabellate, consisting in the var. *coalescens*[1] of numerous cylindrical and compressed anastomosing branches, which are generally in one plane. One variety (var. *lobata*) is massive with lobate blunt branches. In a third (var. *cylindrica*) the branches are cylindrical and project in all directions.

---

[1] The varietal names *lobata* and *cylindrica* are new; *coalescens* is adopted from a specific name of von Reuss.

Zoœcia with medium-sized apertures; mesopores in single circles around each aperture, but in places less numerous.

DIMENSIONS.

	Von Reuss's types.		B.M. D. 7400.
	mm.	mm.	mm.
Height of zoarium	32	25 ...	60
Width of zoarium	18	30 ...	50
Diameter of apertures ...	—	·15 ...	·1–·12
Distance of zoœcial centres	—	about ·3 ...	·3–·4

DISTRIBUTION.

ENGLAND:

Upper Greensand—Zone of *Schlœnbachia rostrata*: Haldon Hills.
? Lower Greensand: Brickhill, Upware.

FOREIGN:

Cenomanian—Lower Quader: near Dresden, Saxony.
Albian: Grandpré, Ardennes.

FIGURES.

Pl. VIII. Fig. 5. A zoarium of var. *coalescens*. Upper Greensand—zone of *Schlœnbachia rostrata*: Haldon. Fig. 5*a*, the whole zoarium; nat. size. Fig. 5*b*, part of the surface; × 10 dia. **D. 7400.**

Pl. IX. Fig. 1. A zoarium of var. *lobata*. Upper Greensand—zone of *Schlœnbachia rostrata*: Haldon. Fig. 1*a*, the whole zoarium; nat. size. Fig. 1*b*, part of the surface; × 10 dia. **D. 7399.**

Pl. IX. Fig. 2. A zoarium of var. *cylindrica*. Upper Greensand — zone of *Schlœnbachia rostrata*: Haldon. Fig. 2*a*, the zoarium from above; nat. size. Fig. 2*b*, part of the surface; × 10 dia. **D. 7405.**

AFFINITIES.

In spite of the difference in form of these three varieties, they appear to be all members of one species. The zoœcial arrangement agrees essentially with that of the type of von Reuss, though the closeness of the zoœcia varies in different specimens (cf. Pl. IX. Figs. 1*b* and 2*b*) and in different parts of the same specimen.

Keeping remarks in the specimens from the Lower Greensand of Upware and Brickhill that a zonal arrangement of the apertures may be detected in parts of the zoarium.

LIST OF SPECIMENS.

Var. *lobata* series, with lobate branches.

D. 7399. A large zoarium, 70 mm. long by 45–50 mm. high, with lobose to blunt branches ; the cylindrical branches are about 15 mm. thick. The mesopores number about four or a few more in each circle. Upper Greensand—zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll. Figd. Pl. IX. Fig. 1.

D. 7402. A zoarium with some longer branches and many blunt lobate branches. The base is incrusting and was probably attached to seaweed. Upper Greensand—zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll.

D. 7403. A zoarium with a narrower base and longer and more regular branches, which occasionally anastomose. The branches are 8 mm. in diameter. The surface is preserved in patches, showing the plan of the mesopores to be the same as that of **D. 7399.** Upper Greensand — zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll.

D. 7404. Zoarium of a thick branch, 14 mm. long and 10 mm. thick, which bifurcates at intervals of 8 mm. ; it has a broad incrusting base that has grown around a cylindrical stem. Mesopores uniserial and about four in a circle. Upper Greensand—zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll.

D. 7406. A thick branch, 15 mm. wide, 10 mm. thick, and 25 mm. long ; it has a hollow axis. Mesopores as in **D. 7404.** Upper Greensand —zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll.

D. 7407. Part of a zoarium with irregular branches, all in one plane from a broad base. Mesopores as in **D. 7404.** Upper Greensand—zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll.

D. 7408. Zoarium with a broad base, partially incrusting a shell ; the zoarium is broad and compressed, with a series of blunt lobate projections, all in one plane. Mesopores as in **D. 7404.** Upper Greensand—zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll.

D. 7411. A flattened nodular zoarium, very corroded and with a hollow base. The lobate branches anastomose above, leaving a lunule. Upper Greensand — zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll.

D. 7412. An irregular zoarium with an incrusting base, from which rise short thick projections, with short blunt branches from 4 to 7 mm. in diameter. Upper Greensand — zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll.

Var. *coalescens*, Rss.

D. 7400. Zoarium flabellate with anastomosing branches; it is 7–12 mm. broad by 7 mm. thick. The zoarium gives off above short cylindrical branches. Mesopores in a single circle around the apertures. About four mesopores in each circle. Upper Greensand—zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll. Figd. Pl. VIII. Fig. 5.

D. 7401. A more complex zoarium, tending to form two irregularly flabellate branches, each connected by cross branches. Branches broad with small lunules. Upper Greensand—zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll.

D. 7409. Part of a zoarium, 32 mm. high by 28 mm. wide at the top; one or two lunules left between the united branches. Mesopores as in **D. 7400.** Upper Greensand—zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll.

D. 7410. Fragment of a zoarium, similar to **D. 7409.** Upper Greensand—zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll.

D. 7417. Part of another similar zoarium. Upper Greensand—zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll.

Var. *cylindrica.*

D. 7405. Part of a small zoarium with narrow, sub-cylindrical branches, 5 × 4 mm. in diameter. Upper Greensand—zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll. Figd. Pl. IX. Fig. 2.

D. 7413. A branch 22 mm. long; it is 11 mm. wide by 7 mm. thick at the base; the lower part of the branch is 7 mm. in diameter, and the upper part of the branch below the last remaining bifurcation is 5 mm. in diameter. Upper Greensand—zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll.

D. 7414. A branch 22 mm. long, containing the base and the first bifurcation; it is 4 × 3 mm. in diameter. Upper Greensand—zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll.

? D. 7419. A very worn branch; it has one bifurcation, of which one arm is 3 × 3 mm. in diameter and the other 5 × 4 mm. Upper Greensand—zone of *Schlœnbachia rostrata.* Haldon, Devon. Bequeathed Vicary Coll.

5. **Heteropora subæquiporosa,**[1] Gregory, 1909.

SYNONYMY.

Heteropora subæquiporosa, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 64.

DIAGNOSIS.

Zoarium funnel-shaped, composed of a thick layer around a hollow axis.

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[1] Named from the slight difference in size between the zoœcia and mesopores.

Surface pustular, with irregular, indefinite tubercles or knobs.

Mesopores large; in single lines between the apertures, but not well marked off from the zoœcia.

DIMENSIONS.

	mm.
Height of zoarium	60
Diameter of zoarium	25
Thickness of wall at upper end	about 10
Diameter of apertures	·12–·15
Diameter of mesopores	·06–·08

DISTRIBUTION.

Upper Greensand: Warminster.

FIGURES.

Pl. VIII. Fig. 4. Fig. 4*a*, zoarium from the side; nat. size. Fig. 4*b*, from above; nat. size. Fig. 4*c*, part of the surface; × 10 dia. **D. 3177.**

AFFINITIES.

This species is nearly allied to *H. nodosa* (d'Orb.), from which it differs by the regular arrangement of the tubercular elevations in that species; and also by the somewhat different arrangement of the apertures, which appear in *H. nodosa* to be collected into groups.

D. 3177. The type-specimen. Upper Greensand. Warminster, Wiltshire. J. Brown Coll. Figd. Pl. VIII. Fig. 4.

6. Heteropora korycanensis, Novak, 1877.

SYNONYMY.

Heteropora korycanensis, Novak, 1877. Bry. böhm. Kr.: Denk. Ak. Wiss. Wien, vol. xxxvii. pt. ii. p. 114, pl. ix. figs. 6–9.

DIAGNOSIS.

Zoarium dendroid; of thick, irregular, cylindrical branches, with tubercular surface. The branches are mostly in one plane, and are usually elliptical in section.

Apertures small, round, or subangular; widely and irregularly spaced.

Mesopores very numerous; often in biserial circles around the apertures.

DIMENSIONS.

Zoarium of branches, 3–10 mm. thick, 10–25 mm. long.

Distribution.

Cenomanian—Korycaner Schichten: Korycany, near Prag, Bohemia.

Affinities.

According to Novak this species is allied to *H. crassa*, Hag., and its nearest ally is *H. surculacea*, Mich., from which it differs by the arrangement and number of both zoœcia and mesopores.

D. 4438. One zoarium. Cenomanian — Korycaner Schichten. Korycany, Bohemia. Purchased of Dr. Anton Frič.

UNREPRESENTED AND DOUBTFUL SPECIES.

1. **annulata,** Keeping, 1883.

Syn. *Heteropora* (*Nodicrescis*) *annulata*, Keeping, 1883. Foss. Neoc. Upware, p. 142, pl. vii. figs. 16*a*, *b*.

Char.—Zoarium large (100 mm. across), of stout, short, digitate branches, which may expand distally. The branches, which are about 12 mm. in diameter, may anastomose. The sides of the branches are marked by annular lines. Apertures small, square, or round; widely scattered, and between them are two series of mesopores, which are half the diameter of the zoœcial apertures.

Distrib.—Lower Greensand: Upware.

Aff.—A close ally of *H. buskana*, Lor., from which it differs mainly by the annulation and distal expansion of its branches.

2. **anomalopora** (Ubaghs), 1858 (*non* Goldf.).

Syn. *Nodicrescis anomalopora*, Ubaghs, 1858. Neue Bry. Maestr.: Palæontogr. vol. v. p. 130, pl. xxvi. figs. 4, 5.
Heteropora anomaloporata, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 226.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 36.

Char.—Zoarium of cylindrical, erect, thick, dichotomous branches, with a mammillated surface. Apertures irregularly and sparsely scattered and represented as angular; separated by two rows of mesopores.

Distrib.—Senonian—Maastrichtian: Maastricht.

Aff.—A close ally of *H. tuberculata* (d'Orb.), but with biserial instead of uniserial mesopores between the apertures.

3. **buskana,** de Loriol, 1863.

Syn. *Heteropora buskana*, de Loriol, 1863. Invert. Néoc. moy. Mt. Salève, pt. ii. p. 148, pl. xviii. fig. 6.
,, *major*, Keeping, 1883. Foss. Neoc. Upware, p. 144, pl. vii. fig. 18.

Char.—Zoarium of cylindrical, dichotomous branches, arising from a broad, thin, flat base, or with crowded branches like a bush. Apertures distant, with two series of mesopores between each.

Distrib.—English: Lower Greensand: Upware. Foreign: Neocomian: La Varappe, Mt. Salève, Switzerland.

Aff.—Allied to *H. constanti*, which has fewer mesopores, and those uniserial.

4. ?n.sp., *non* **clavula** (Koch & Dunker), 1837.

Syn. *non Ceriopora clavula*, Koch & Dunker, 1837. Beitr. nordd. Ool. p. 55, pl. vi. fig. 13.
,, ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 95.
non Heteropora ,, d'Orbigny, 1854. Bry. Crét. p. 1070.
,, ,, Etheridge & Newton, 1878. Cat. Crét. Foss.: Mus. Pract. Geol. p. 7.

Distrib.—Lower Greensand: Farringdon.

Aff.—The type-specimen from the Neocomian of Elligser Brink, Hanover, as figured by Koch & Dunker, is clearly not a Bryozoan. The specimen from the Lower Greensand of Farringdon, identified as *Heteropora clavula* by Etheridge & Newton, is a Heteroporid. It has an elegant, club-shaped zoarium, 13 mm. high, 5 mm. in diameter above, and with a stem 2·2 mm. in diameter. It may be a new species of *Fungella*.

5. *non* **concinna**,[1] Römer, 1840.

(*Vide Sparsicavea*, Vol. I. p. 396.)

Syn. *Heteropora concinna*, Römer, 1840. Verst. nordd. Kr. p. 24, pl. v. fig. 27.
,, ,, d'Orbigny, 1854. Bry. Crét. p. 1070.

6. **constanti** (d'Orbigny), 1850.

Syn. *Ceriopora constanti*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 143.
Heteropora ,, d'Orbigny, 1854. Bry. Crét. p. 1071, pl. 799, figs. 6, 7.
,, *dichotoma* (*non* Goldf.),[2] Michelin, 1841. Icon. Zooph. p. 4, pl. i. fig. 11.

Char.—Zoarium of thin dichotomising branches (2–5 mm. diameter). Surface smooth, but an indication of faint annulation. Apertures pentagonal. Mesopores in a single line between the apertures.

Distrib.—Albian: Grandpré, Ardennes.

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[1] The reference in Vol. I. is given as p. 4, and the reference to d'Orbigny omitted.

[2] The *Ceriopora dichotoma* of Goldfuss, i.e. the *Heteropora dichotoma* of de Blainville, Römer, von Hagenow, Drescher, etc., is *Sparsicavea dichotoma* (cf. Vol. I. p. 393). The *Heteropora dichotoma* of von Reuss, 1847 (Foss. Polyp. Wien, Tertiärb.: Naturw. Abh. vol. ii. p. 35, pl. v. fig. 20), of the Austrian Leithakalk, has double rows of mesopores between the apertures.

7. coronata, von Reuss, 1872.

Syn. *Heteropora coronata*, von Reuss, 1872. Bry. unt. Quad.: Palæontogr. vol. xx. pt. i. p. 130, pl. xxxii. figs. 6, 7.

Char.—Zoarium of cylindrical branches of 3 to 4 mm. in diameter. Mesopores uniserial. Apertures about ·3 mm. in diameter. Distance of zoœcial centres from ·4 to ·7 mm.

Distrib.—Cenomanian—Lower Quader: Plauen, Saxony.

Aff.—This species is a close ally of *H. orbignyi*, but has narrow branches, and the zoœcia are larger. Thus the diameter of the apertures in this species is ·3 mm., whereas in *H. keepingi* (p. 190) it is ·15 mm.

8. crassa, *pars*, von Hagenow, 1851.

Syn. *Ceriopora micropora*, *pars*, Goldfuss, 1827. Petref. Germ. vol. i. p. 33, pl. x. fig. 4*a* (*non* 4*d*).
Heteropora crassa, *pars*, von Hagenow, 1851. Bry. maastr. Kr. p. 46, pl. v. fig. 13 (*non* 12).
,, ,, ,, Kade, 1852. Los. Verst. Schanzenb. p. 32.
,, ,, ,, d'Orbigny, 1854. Bry. Crét. p. 1070.
? *Multicavea crassa*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 40.

Char.—Zoarium nodular, with a broad base, and expanding above; it is short and cylindrical, with convex upper surface. Mesopores usually one line between the zoœcia.

Dimensions.

		mm.
Zoarium:	height	18
,,	diameter...	9–11

Zoœcia: number per sq. mm. about 13 (von Hagenow, fig. 13*d*).

Distrib.—Senonian—Maastrichtian: Maastricht.

Aff.—The species, as here restricted, does not include the branching zoarium with from two to three lines of mesopores between the zoœcia, shown by von Hagenow (Bry. maastr. Kr. pl. v. fig. 12); for, according to Hamm, the apertures in that specimen are arranged in stellate groups, and he says that von Hagenow overlooked this character. That specimen may therefore be a new species, and may be a *Radiopora*. The type of the species, according to von Hagenow, is at Bonn.

9. *non* **decipiens**, Peron, 1893.

Syn. *Heteropora decipiens*, Peron, 1893. Descr. invert. foss. terr. crét. sud Tunisie, p. 353, pl. xxx. figs. 27–30.

Char.—Zoarium of dichotomous branches, which are as much as 3 mm. in diameter. The zoœcia are hexagonal in section, with an elliptical aperture. No mesopores.

Distrib.—Turonian: Southern Tunis.

Aff.—MM. Thomas & Peron discuss the relationships of this species to genera ranging from *Biflustra* and *Flustrella* to *Entalophora*; and also to the species *Heteropora constanti* (d'Orb.) and *Nodicrescis tuberculata* (d'Orb.), both of which have abundant mesopores. Without sections showing the internal structure, even the family to which this species belongs is uncertain. It is not a *Heteropora*.

10. *non* **dollfusi.**

Syn. *Heteropora dollfusi*, Pergens, 1894. Nouv. Bry. Crét. Limb.: Bull. Soc. belge Géol. vol. vii., Mém. p. 174, pl. x. fig. 4 (*non* 2 as quoted in text).

Distrib.—Senonian—Maastrichtian: Limbourg.

Aff.—A very irregular *Petalopora*.

11. **edwardsi** (de Loriol), 1863.

Syn. *Nodicrescis edwardsi*, de Loriol, 1863. Invert. Néoc. moy. Mt. Salève, pt. ii. p. 147, pl. xviii. fig. 7.

Char.—Zoarium dendroid; of thin cylindrical branches (5–6 mm. diameter), which dichotomise repeatedly and have long pointed ends. The surface is irregularly mammillated, and the mammillæ are irregular both in shape and distribution. Apertures round; widely spaced and separated by two lines of mesopores.

Distrib.—Neocomian: La Varappe, Mt. Salève.

Aff.—Allied to *H. tuberculata*, but with more mesopores, there being two lines between the apertures.

12. **foraminulenta,** Novak, 1877.

Syn. *Heteropora foraminulenta*, Novak, 1877. Bry. böhm. Kr.: Denk. Ak. Wiss. Wien, vol. xxxvii. p. 114, pl. ix. figs. 3–5.

,, *polytaxis*, *pars*, Pergens & Meunier, 1887. Bry. gar. Faxe: Ann. Soc. malac. Belg. vol. xxi., Mém. p. 223.

Char.—Zoarium a small tuft of short, thick, club-shaped branches rising from a single stem. Branches elliptical in section. Mesopores scarce and irregular, less numerous than the zoœcia.

Dimensions.—Zoarium, 15 mm. high by 15 mm. wide.
Basal stem, 5 mm. in diameter.

Distrib.—Cenomanian—Korycaner Schichten: Kolin, Bohemia.

13. **multiplex** (de Loriol), 1868.

Syn. *Semicava multiplex*, de Loriol, 1868. Mon. Valang. Arzier: Pal. Suisse, ser. 4, pt. ii. p. 66, pl. vi. fig. 56.

Char.—Zoarium a thick sheet, which may completely envelop the body to which it is attached; sometimes raised in rounded expansions. Apertures very small and slightly polygonal; they are sparsely scattered and separated by thick walls.

Distrib.—Valangian: Arzier, Switzerland.

14. ? nodosa (d'Orbigny), 1854.

Syn. *Seminodicrescis nodosa*, d'Orbigny, 1854. Bry. Crét. p. 1067, pl. 800, figs. 12–14.

Char.—Zoarium a hollow tube that has possibly grown as an incrustation around a seaweed; the surface is tuberculated, with the apertures rather crowded round the edges of the tubercles.

Distrib.—Aptian: Saint-Dizier, Haute-Marne; les Croûtes, Aube.

Aff.—This species is possibly a *Radiopora.*

15. parvicella, Gabb & Horn, 1860.

(*Vide Petalopora*, in Addenda, Vol. II. p. 303.)

16. ? ramosa (d'Orbigny), 1854.

Syn. *Semimulticrescis ramosa*, d'Orbigny, 1854. Bry. Crét. p. 1078, pl. 800, figs. 15–17.
Ditaxia ramosa, Pergens, 1890. Rev. p. 337.

Distrib.—Cenomanian: Le Mans.

Aff.—It is suggested in Vol. I. p. 426, that this species is possibly a *Reptomulticlausa.*

17. ? ramosa (de Loriol), 1863.

Syn. *Semicrescis ramosa*, de Loriol, 1863. Invert. Néoc. moy. Mt. Salève, pt. ii. p. 149, pl. xv. fig. 27.
non ,, ,, Etheridge & Newton, 1878. Cat. Cret. Foss. Mus. Pract. Geol. p. 7.

Char.—Zoarium in large hollow tubes, 30 mm. in diameter. Apertures circular; separated by two lines of mesopores, and perhaps zonally arranged.

Distrib.—Neocomian: La Varappe, Mt. Salève.

Aff.—This species is common at Mt. Salève, but so badly preserved that M. de Loriol left its affinities in doubt, and suggested that it should be regarded as the type of a new genus, *Semizonopora*, owing to the possibly zonal arrangement of the apertures.

18. surculacea, Michelin, 1846.

Syn. *Heteropora surculacea*, Michelin, 1846. Icon. Zooph. p. 209, pl. li. fig. 8.
,, ,, d'Orbigny, 1854. Bry. Crét. p. 1070.
,, ,, von Reuss, 1872. Bry. unt. Quad.: Palæontogr. vol. xx. pt. i. p. 130, pl. xxxii. figs. 8, 9.
Ceriopora ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 184.

Char.—Zoarium dendroid, with irregular branches, which are very thick, being up to 13 mm. in diameter. Mesopores very few, as many or less numerous than the apertures.

Distrib.—Cenomanian—Unter Quader: (? Plauen), Saxony.
Le Mans.
Albian: Grandpré, Ardennes.

19. **tuberculata** (d'Orbigny), 1854.

SYN. *Nodicrescis tuberculata*, d'Orbigny, 1854. Bry. Crét. p. 1066, pl. 800, figs. 8, 9.
,, ,, Pergens, 1890. Rev. p. 375.

CHAR.—Zoarium dendroid, with thick branches (15 mm. diameter) covered with crowded tubercles. Apertures crowded, with uniserial mesopores.

DISTRIB.—Senonian: Saintes, Charente-Inférieure.

AFF.—The type, according to M. Pergens, is lost. This species is most nearly allied to *H. edwardsi* (de Lor.).

20. *non* **variabilis** (d'Orbigny), 1853.

SYN. *Zonopora variabilis*, d'Orbigny, 1853. Bry. Crét. p. 931, pl. 771, figs. 9–13.
,, ,, Pergens, 1890. Rev. p. 374.

CHAR.—Thin stems with irregularly scattered distant apertures.

DISTRIB.—Senonian: France.

AFF.—Probably a *Sparsicavea*.

MULTICRESCIS, d'Orbigny, 1854.

[Bry. Crét. p. 1073.]

SYNONYMS.

Millepora, pars, Passy, 1832.
Heteropora, pars, Michelin, 1841; von Reuss, 1848; Ulrich, 1900; etc.
Chætetes, pars, Michelin, 1846.
Polytrema, pars, d'Orbigny, 1850.
Ceriopora, pars, d'Orbigny, 1850; Morgan, 1882.
Semimulticrescis, d'Orbigny, 1854.
Reptomulticrescis, d'Orbigny, 1854.

DIAGNOSIS.

Heteroporidæ with a massive or branched zoarium, composed of successive thin layers of zoœcia.

TYPE SPECIES.

Multicrescis variabilis, d'Orbigny, 1854. Cenomanian: Le Mans.

AFFINITIES.

This species differs from *Heteropora* by its multilamellar structure; its relations to *Heteropora* are analogous to those of *Reptomulticava* to *Ceriopora*.

D'Orbigny described and figured five Cretaceous species which he referred to *Multicrescis*, and he gave a list of eight species which he also assigned to it. He did not select any one as his type.

M. variabilis may be chosen, as it is better to use one of the species which d'Orbigny figured, and of them *M. variabilis* is probably the commonest and is best illustrated by d'Orbigny's figures.

The genus is represented in the Jurassic by *M. laminata* (Greg.), which I formerly included in *Heteropora*, as in 1896, when cataloguing the Jurassic Bryozoa, I thought the formation of the zoarium by successive layers of zoœcia, though a satisfactory character among the Tubulata, was not of generic value in such Bryozoa as *Heteropora*. I am, however, now disposed to acknowledge the value of this character, and therefore accept d'Orbigny's genus.

1. **Multicrescis variabilis**, d'Orbigny, 1854.

SYNONYMY.

Multicrescis	*variabilis*,	d'Orbigny, 1854. Bry. Crét. p. 1077, pl. 800, figs. 3–7.
? *non* ,,	,,	Vine, 1891. Rep. Cret. Polyz.: Rep. Brit. Assoc. 1890, p. 383.
? *non* ,,	,,	Vine, 1892. Addit. Cret.: Proc. Yorks. Geol. Soc. vol. xii. p. 161, pl. vi. figs. 13, 14.
non ,,	,,	Gamble, 1896. Cat. Bry. Chatham, p. 4.
Heteropora	,,	Novak, 1877. Bry. böhm. Kr.: Denk. Ak. Wiss. Wien, vol. xxxvii. pt. ii. p. 116, pl. ix. figs. 10–20.
? ,,	,,	Pergens, 1888. Age Tuf. Ciply: Bull. Soc. belge Géol. vol. i. p. 205.
,,	(*Multicrescis*) *variabilis*,	Pergens, 1890. Rev. p. 373.
,,	*variabilis*,	Počta, 1892. Mech. Koryc. Hory: Ceska Ak. Fr. Jos. Praze, sect. ii. p. 25.
,,	,,	Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 332.
Ceriopora	,,	Morgan, 1882. Terr. crét. Scand.: Mém. Soc. géol. France, ser. 3, vol. ii. No. 2, p. 15.

DIAGNOSIS.

Zoarium short, clavate; a short ringed stalk, expanding above, where it is domed or slightly lobed, or cut into short blunt branches.

Mesopores scarce, about as numerous as the zoœcia.

The apertures of the zoœcia are surrounded by a slight rim.

DIMENSIONS.

	D'Orbigny's type. mm.	B.M. D. 3179. ? Haldon. mm.
Height of zoarium	9	22
Diameter of zoarium	7	23 × 18
Diameter of stalk	3	8

Distribution.

British:[1]

Upper Greensand: Haldon Hills, Devonshire.

Foreign:

? Senonian: Ciply (*fide* Pergens); Qvarnby, Sweden (*fide* Morgan).

Cenomanian: Le Mans.

Kalkmergel: Kamajk, Kolin, Zbislav, and Kank, Bohemia.

Figures.

Pl. V. Fig. 6*a*, a zoarium from the side; nat. size. Fig. 6*b*, part of the zoarium; × 10 dia. Upper Greensand: England (? Haldon Hills). **D. 3179.**

LIST OF SPECIMENS.

D. 3179. A zoarium 22 mm. high. Upper Greensand. ? Haldon Hills. Figd. Pl. V. Figs. 6*a*, *b*. Old Coll.

D. 7415. Part of a worn broken zoarium, 14 mm. high, 10 mm. in diameter at the base, 7 mm. diameter in the stalk, and with lobes 6 mm. in diameter. The plan of the zoœcia agrees with that of *H. variabilis*, but the base is more expanded and the lobes more independent. Upper Greensand—zone of *Schlœnbachia rostrata*. Haldon Hills, Devonshire. Vicary Coll. Bequeathed 1903.

2. **Multicrescis tuberosa**[2] (Römer), 1839.

Synonymy.

Heteropora tuberosa, Römer, 1839. Verst. nordd. Ool., Nachtrag, p. 12, pl. xvii. fig. 16 (not fig. 8 as stated by misprint on the plate).

,, ,, Römer, 1840. Verst. nordd. Kr. p. 23.

Ceriopora ,, von Hagenow, 1846. In Geinitz, Grundr. Verst. vol. ii. p. 507.

non ,, ,, Michelin, 1846. Icon. Zooph. p. 208, pl. liii. fig. 1.

non ,, ,, d'Orbigny, Kade, 1852. Los. Verst. Schanzenb. p. 32.

Polytrema subtuberosa, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 94.

Radiopora heteropora, *pars*, d'Orbigny, 1854. Bry. Crét. p. 993.

,, ,, Canu, 1902. Bry. foss. i., Coll. Camp.: Bull. Soc. géol. France, ser. 4, vol. ii. p. 12.

Reptomulticrescis neocomiensis, de Loriol, 1863. Invert. Néoc. moy. Mt. Salève, pt. ii. p. 150, pl. xix. fig. 1.

Diagnosis.

Zoarium massive, nodular, and broad-based, or it may be raised in a short thick stump; the upper surface may be smooth, but in well-preserved specimens is marked by faint circular or subcircular elevations.

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[1] The specimens, on the evidence of which this species has been recorded from the Middle Chalk of Chatham, are described later (p. 281) as *Tholopora cantiana*.

[2] For a list of species named *tuberosa* see p. 129.

Apertures large, circular, distant.

Mesopores very numerous; there are usually two rows between neighbouring apertures.

DIMENSIONS.

	D. 7075.
	mm.
Height of zoarium	13
Diameter of zoarium	5
Diameter of zoœcia	·2
Distance of zoœcial centres	·4
Diameter of mesopores	·1
Number of apertures of zoœcia per sq. mm. ...	8–10

DISTRIBUTION.

Neocomian—Hilsconglomerat: Schandelahe, Schöppenstedt, Berklingen, Kissenbruck, Brunswick; Goslar, Hannover; Rauschenberg, Hesse. Sainte-Croix (*fide* Canu); Censeau, near Salins, Jura; La Varappe, Mont Salève, Switzerland.

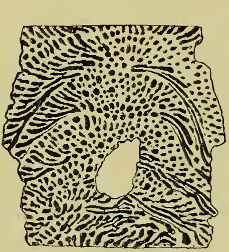

FIG. 52.—*Multicrescis tuberosa.* Vertical section; × 2¼. **D. 7075a.**

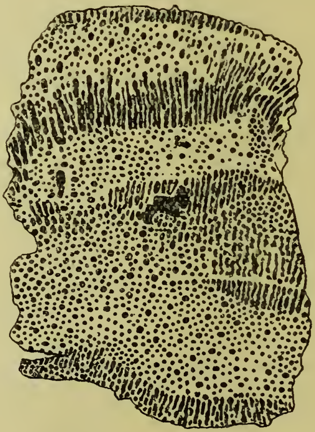

FIG. 53.—*Multicrescis tuberosa.* Vertical section; × 6⅔. **D. 7075b.**

FIGURES.

Pl. IX. Fig. 4*a*. The side view of a stump-shaped zoarium; × 3 dia. Fig. 4*b*, the polished reverse side of the same specimen; × 3 dia. Neocomian: Goslar. Krantz Coll. **D. 7075a.**

Fig. 52. Part of a thin vertical section of the same specimen; × 2¼ dia. **D. 7075a.**

Fig. 53, p. 206. Part of a vertical section through another zoarium; × 6⅔ dia. Neocomian: Goslar. Krantz Coll. **D. 7075b.**

Fig. 54. A thin vertical section showing three layers out of the seven in the section (*m.* = mesopores); × 6⅔ dia. Neocomian: Berklingen. Saemann Coll. **D. 11,827.**

Affinities.

M. de Loriol le Fort's *R. neocomiensis* agrees in all essentials with this species, and it was founded on a zoarium from Mt. Salève, 24 mm. in diameter and 21 mm. high, with a pointed base and rounded, smooth upper surface.

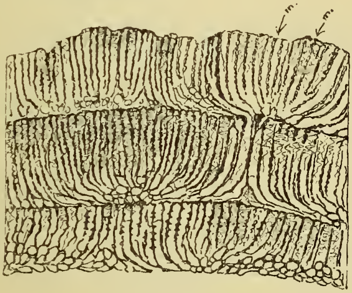

Fig. 54.—*Multicrescis tuberosa.* Part of vertical section; × 6⅔. **D. 11,827.**

The name *Polytrema subtuberosa* was given by d'Orbigny in 1850 to the second figure numbered 8 on Römer's pl. xvii., which is *Multicrescis tuberosa*. But later on (Bry. Crét. p. 993) d'Orbigny made the name *subtuberosa* a synonym of the species represented on the correct figure No. 8 of the same plate, which is the *Radiopora heteropora*, d'Orb. This change in opinion by d'Orbigny is clear, as in 1850 his species *subtuberosa* was founded for the *Heteropora tuberosa*, Röm.; whereas in 1854 the name *subtuberosa* was dismissed (d'Orb. Bry. Crét. p. 993) as a synonym of *Radiopora heteropora.*

The worn specimen from Géovressiat, near Nantua, Ain, identified by d'Orbigny with the *Heteropora tuberosa*, Röm., in 1850, and with *Radiopora tuberosa* in 1852, is not quoted by Pergens, and is here referred (p. 284) to *Radiopora neocomiensis* (d'Orb.).

Römer's *Heteropora tuberosa* of 1840 is clearly intended for the species he had thus founded in 1839; but d'Orbigny (Bry. Crét. p. 993) separated Römer's 1840 reference and included it in

Radiopora heteropora; but Römer expressly states that his 1840 reference was to the specimen shown on "Tab. 17, fig. 16 (8)."

There has been some confusion about the three species named by Römer and figured in Verst. nordd. Ool., Nachtrag, pl. xvii. as figs. 7–9 and 16; they may be tabulated as follows:—

7*a*, *b*, *Alveolites heteropora*, Röm. = ? an adnate *Ceriopora heteropora*.
8*a*, *b* ,, ,, ,, = *Ceriopora heteropora* (Röm.).
9*a*–*c* ,, *tuberosa* ,, = ,, *tuberosa* (Röm.).
16 *Heteropora* ,, ,, = ? *Multicrescis* ,, (Röm.).

LIST OF SPECIMENS.

D. 7075a. A zoarium and slide. Neocomian. Goslar, near Harz, Hanover. Krantz Coll. Figd. Pl. IX. Figs. 4*a*, *b*, and section, Fig. 52, p. 206.

D. 7075b. A second specimen and two slides, with thin sections. Neocomian. Goslar, near Harz, Hanover. Krantz Coll. Section, Fig. 53, p. 206.

D. 11,827. A zoarium, 25 mm. in diameter and 18 mm. thick, and a thin transverse section cut from it. Neocomian—Hilsconglomerat. Berklingen, Brunswick. Saemann Coll. Fig. 54, p. 207.

B. 1913. A small, almost hemispherical zoarium, 18 × 15 × 13 mm. in diameter, with distinct circular elevations, about 2 mm. in diameter, scattered over the upper surface. Neocomian—Hilsconglomerat. Rauschenberg, Hesse. Presented by J. E. Lee, Esq.

D. 3648. A somewhat clavate zoarium, 10 mm. high, 8 × 6 mm. in diameter, with small apertures, which are widely scattered among the numerous mesopores. The form of the zoarium is connected to that of this species by the larger specimen in **D. 11,828.** Neocomian—Hilsconglomerat. Berklingen, Brunswick. Saemann Coll.

D. 11,828. Two nodular irregular zoaria. One is 24 × 18 mm. wide by 18 mm. thick; the other is 26 × 19 mm. wide by 27 mm. thick. Its surface shows the circular elevations over part of the upper surface. Lower Neocomian. Censeau, near Salins, Jura. Saemann Coll.

UNREPRESENTED SPECIES.

1. **digitata** (Passy), 1832.

Syn. *Millepora digitata*, Passy, 1832. Descr. Géol. Seine-Infér. p. 339, pt. x. pl. xvi. fig. 8.
Heteropora ,, Michelin, 1844. Icon. Zooph. p. 124, pl. xxxiv. fig. 4.
Multicrescis ,, d'Orbigny, 1854. Bry. Crét. p. 1074.

Char.—Zoarium dendroid, with irregular, knobby branches. Generic characters indet.

Distrib.—Senonian—Campanian: Craie à silex, Tours.

Aff.—Possibly allied to *Heteropora cryptopora*, which differs by its pointed branches.

2. *non* **labiata**, Gabb & Horn, 1862.

Syn. *non Crescis labiata*, Gabb & Horn, 1862. Mon. foss. Polyz.: Journ. Acad. Nat. Sci. Phil. ser. 2, vol. v. p. 177, pl. xxi. fig. 69.
,, ,, ,, Johnson, 1905. Annot. List: Proc. Acad. Nat. Sci. Phil. vol. lvii. p. 5.

Distrib.—Senonian — Maastrichtian: Vincentown and Timber Creek, New Jersey.

Aff.—The species is a *Porina*.

3. **lobata** (Michelin), 1846.

Syn. *Chætites* [*sic*] *lobatus*, Michelin, 1846. Icon. Zooph. p. 201, pl. li. fig. 6.
Polytrema lobata, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 184.
Reptomulticrescis lobata, d'Orbigny, 1854. Bry. Crét. p. 1080.

Char.—Zoarium massive, with large lobes and with a mammillated surface. Apertures large, with distinct rounded peristomes; crowded with small mesopores in the angles, slightly more numerous than the zoœcia.

Distrib.—Cenomanian: Le Mans.

4. **mammillata**, d'Orbigny, 1854.

Syn. *Multicrescis mammillata*, d'Orbigny, 1854. Bry. Crét. p. 1076, pl. 800, figs. 1, 2.
,, ,, Pergens, 1890. Rev. p. 375.

Char.—Zoarium a tuft of thick, blunt, thumb-shaped branches, rising from a short, ringed, cylindrical stem. Mesopores in a single line between the apertures.

Distrib.—Albian: Grandpré, Ardennes.

5. **mirabilis** (d'Archiac), 1846. Name only.

Syn. *Heteropora mirabilis*, d'Archiac, 1846. Cret. versants Plat. centr.: Mém. Soc. géol. France, sér. 2, vol. ii. No. i. p. 58.

Distrib.—Senonian—*Spondylus* bed: near Tours.

6. **ricordeana**, d'Orbigny, 1854.

Syn. *Multicrescis ricordeana*, d'Orbigny, 1854. Bry. Crét. p. 1075, pl. 799, figs. 11–13.
Heteropora (*Multicrescis*) *ricordeana*, Pergens, 1890. Rev. p. 373.

Char.—Zoarium dendroid, of thick, digitate, blunt branches. Apertures with highly raised rims. Mesopores few; only slightly more numerous than the zoœcia.

Distrib.—Aptian: Vassy, Haute-Marne; les Croûtes, Aube; Gurgy, Yonne.

Aff.—This species corresponds in *Multicrescis* to *H. surculacea* in *Heteropora*; in addition to the generic characters the two species differ by the raised rims of the apertures, which give *H. ricordeana* somewhat the aspect of a coral.

7. spongioides (Michelin), 1841.

Syn. *Heteropora spongioides*, Michelin, 1841. Icon. Zooph. p. 3, pl. i. fig. 3.
Polytrema ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 143.
Reptomulticrescis ,, d'Orbigny, 1854. Bry. Crét. p. 1079.

Char.—Zoarium massive, nodular, with irregular upper surface. Apertures small. Mesopores uniserial.

Distrib.—Albian: Grandpré and Machéroménil, Ardennes.

Aff.—This species corresponds to *H. tuberosa*, but with uniserial mesopores.

BIFLABELLARIA, Pergens, 1894.

[Nouv. Bry. Crét. Limb.: Bull. Soc. belge Géol. vol. vii., Mém. p. 172.]

Diagnosis.

Heteroporidæ with a flabelliform zoarium, which consists of two layers on a median lamella. (The zoœcia are said by Pergens to be dimorphic, and the smaller zooids agree with *Heteropora* and *Lichenopora*.)

The zoarium has numerous piriform depressions occupied only by the mesopores.

Type Species.

B. apathyi, Pergens: op. cit. p. 172, pl. viii. fig. 1. Senonian—Maastrichtian: Maastricht.

Affinities.

Allied to *Heteropora*, but with a frondose or flabelliform zoarium and with the groups of mesopores in piriform depressions, corresponding to the 'maculæ' of some Palæozoic Trepostomata.

UNREPRESENTED SPECIES.

apathyi, Pergens, 1894.

Syn. *Biflabellaria apathyi*, Pergens, 1894. Nouv. Bry. Crét. Limb.: Bull. Soc. belge Géol. vol. vii., Mém. p. 172, pl. viii. figs. 1, 1*a*.

Char.—As in the genus. Zoœcial apertures ·12 mm. in diameter. Mesopores ·06 to ·09 mm. in diameter.

Distrib. — Senonian — Maastrichtian: Petit Lanaye and Mt. St. Pierre, Maastricht.

ZONATULIDÆ.

SYNONYMS.

Caveidæ, pars, d'Orbigny, 1853.
Frondiporidæ, pars, Busk, 1859.
Cerioporidæ, pars, Hamm, 1881.
Entalophoridæ, pars, Pergens, 1890.

DIAGNOSIS.

Trepostomata with dimorphic zoœcia. The mesopores are abundant, and are restricted to special areas separating groups or bands of apertures.

The zoarium is dendroid.

AFFINITIES.

This family is most nearly allied to the Heteroporidæ, from which it differs by the grouping of the apertures.

The apertures may be in spiral bands or rings as in *Zonatula*, in alternate groups or bands as in *Multizonopora*, or in raised humps as in *Plethopora* and *Sparsicytis*.

ZONATULA, Hamm, 1881.

[Bry. mastr. Ob.-Sen. i., Cycl. p. 38.]

SYNONYMS.

Zonopora, pars, d'Orbigny, 1854; Vine, 1890–1.
Plethopora, pars, von Hagenow, 1851.
Heteropora, pars, Pergens, 1890; Vine, 1893.
Ceriopora, pars, Pergens, 1894.

DIAGNOSIS.

Zonatulidæ with a dendroid zoarium of cylindrical stems, which are marked by spiral or annular constrictions. The zoarium is non-lamellar in structure.

The mesopores are arranged in bands between the apertures of the zoœcia. The bands of mesopores may be spiral or annular, and are depressed, giving rise to the spiral or zonal aspect of the stems. The walls of the zoœcia appear moniliform in longitudinal sections.

Apertures flush with the surface of the zoarium.

TYPE SPECIES.

Plethopora pseudotorquata, von Hagenow, 1851. Senonian—Maastrichter Kalk: Maastricht.

AFFINITIES.

This genus is a near ally of *Plethopora*, but differs by the arrangement of the mesopores in bands, alternating with the apertures, instead of in raised groups or tufts. The walls of the zoœcia are strongly moniliform.

The genus has often been confused with *Zonopora*, the type species of which is *Zonopora spiralis*, a species that has also been used as the type of *Spiroclausa*. *Zonopora*, however, has corkscrew-shaped stems with bands of zoœcia, separated by bands of dactylethræ; Hamm's institution of the genus *Zonatula* was therefore a useful step.

The most primitive species of this genus is the Neocomian *Z. cottaldina*, in which the apertures are in verticils around the stem; from this species there is a gradual passage to *Z. irregularis*, in which the complete circle of apertures is broken up into two regular, alternate, wedge-shaped groups. In the Albian *Z. lævigata* these wedge-shaped groups are altered into irregular alternate bands.

Zonatula differs from *Multizonopora* by the lamellar structure of the zoarium in the latter genus.

1. **Zonatula pseudotorquata** (von Hagenow), 1851.

SYNONYMY.

Plethopora pseudotorquata, von Hagenow, 1851. Bry. maastr. Kr. p. 45, pl. v. fig. 9.

,, ,, Winkler, 1864. Mus. Teyl., Cat. Pal. livr. ii. p. 208.

Zonopora ,, d'Orbigny, 1854. Bry. Crét. p. 29.

,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 225.

,, ,, Ubaghs, 1888. C.R. Excursion: Bull. Soc. belge Géol. vol. i., Mém. p. 233.

Zonatula ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 38.

Ceriopora kraepelini, Pergens, 1894. Nouv. Bry. Crét. Limb.: Bull. Soc. belge Géol. vol. vii., Mém. p. 177, pl. x. figs. 1, 1*a*.

DIAGNOSIS.

Zoarium dendroid, with thick, cylindrical, dichotomous, and sometimes anastomosing branches. The apertures occur in bands, separated by narrow bands of mesopores along constrictions of the stem.

The bands of mesopores are arranged in a spiral groove in the typical form, or in horizontal constrictions (var. *annulata*[1]), or are somewhat irregular in distribution (var. *irregularis*[1]).

DIMENSIONS.

	Von Hagenow's type. mm.	B.M. specimens.
Height of zoarium	—	Largest specimen is 40 mm. high × 41 mm. wide.
Diameter of branches	5	3–10 mm.; average 5 mm. One specimen at base is 12 mm.
Width of a node from constriction to constriction	3·5 (average of six)	—
Diameter of apertures	·1	·14 mm. (**D. 3468**).
Diameter of mesopores	·033	—

FIGURES.

Pl. VII. Fig. 4*a*. A zoarium from the side; × 2 dia. Fig. 4*b*, the upper surface of the same specimen, showing a transverse section of the main stem and oblique section across base of a branch; × 3 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3366.**

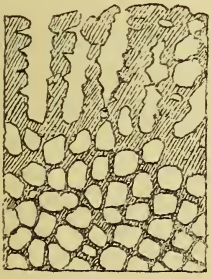

FIG. 55.—**D. 3468.**

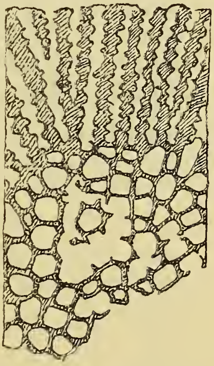

FIG. 56.—**D. 3469.**

Zonatula pseudotorquata, var. *irregularis*. Vertical sections; × 18.

Pl. VII. Fig. 5*a*. A thick zoarium of var. *annulata* from the side; nat. size. Fig. 5*b*, part of the surface of the same specimen; × 6 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **60,164.**

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[1] These varietal names are new.

Fig. 55, p. 213. Part of a vertical section near the edge of a zoarium of var. *irregularis*, showing zoœcia cut longitudinally and transversely, and the moniliform distal walls of the outer zoœcia; × 18 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3468.**

Fig. 56, p. 213. Part of the vertical section of a long branch, 5 mm. in diameter, of var. *irregularis*; × 18 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3469.**

DISTRIBUTION.

Senonian—Maastrichtian: Maastricht and Vetschau.

AFFINITIES.

This species is the type of the genus. The form is variable, but it always has a branched zoarium usually with thick branches.

LIST OF SPECIMENS.

A. Typical variety, with spiral band of mesopores.

D. 3363. Two stems, of which one is 31 mm. long × 5 mm. diameter. Maastrichter Kalk. Maastricht. Van Breda Coll.

60,167. Two stems with the torsion of the stem faintly indicated. The surface agrees exactly with von Hagenow's figure (No. 9*d*). The branches are laterally compressed. The label of the Van Breda Collection identifies the species as "*Millepora madreporacea*, Goldf." Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3411. Two thin branches, 3–4 mm. in diameter; one is 24 mm. long, and shows a very faint torsion. Maastrichter Kalk. Maastricht. Van Breda Coll.

B. Var. *annulata*.

60,164. A thick zoarium with anastomosing branches and two fragments. Maastrichter Kalk. Maastricht. Van Breda Coll. Figd. Pl. VII. Figs. 5*a*, *b*.

D. 3414. Ten stems (in tube). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3366. A specimen with thick branches and annular grooving. Three slides cut from the same zoarium. Section figd. Pl. VII. Fig. 4*b*. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3364. A stem with annular grooving; it is 12 mm. broad at the base; the stem is 6½ mm. in diameter and 18 mm. long. Maastrichter Kalk. Maastricht. Van Breda Coll.

C. Var. *irregularis*. Irregular variety resembling *Ceriopora*, but with irregular laminæ.

D. 3468. A zoarium and thin section. Maastrichter Kalk. Maastricht. Van Breda Coll. Fig. 55, p. 213.

D. 3469. A branch of var. *irregularis*, 20 mm. long × 5 mm. wide, and section from the same. The smaller pores occur in irregular bands and patches. Maastrichter Kalk. Maastricht. Van Breda Coll. The vertical section is figured as Fig. 56, p. 213.

D. 3415. Five stems with irregular laminæ. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3356. A stem 9 mm. in diameter at the hollow base, and tapering regularly upward to 5 mm. diameter at the end. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3404. An irregular stem, 4 mm. in diameter and 19 mm. long; it is hollow above. It is bent, and at the outer angles are groups of apertures, presenting an approach to the condition of *P. verrucosa*. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. Miscellaneous.

D. 3358. A zoarium with anastomosing branches, 33 mm. high × 21 mm. across; the branches are compressed, being 6 mm. wide × 3·5 mm. thick. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3365. Two stems. Maastrichter Kalk. Maastricht. Van Breda Coll.

2. Zonatula brydonei, Gregory, 1909.

SYNONYMY.

Zonatula brydonei, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 64.

DIAGNOSIS.

Zoarium club-shaped, with a short narrow stem and an egg-shaped head. The apertures of the zoœcia are circular or subcircular. They are divided into groups by alternate horizontal laminæ, which extend half-way across the zoarium and divide the apertures into alternate groups.

DIMENSIONS.

	mm.
Height of zoarium	24
Length of head	20
Diameter of head	14
Diameter of stalk	7
Length of stalk	4
Zoœcia: diameter of apertures	·1–·15
Distance of zoœcial centres	·2–·3

DISTRIBUTION.

Lower Greensand (Aptian): Farringdon, Berkshire.

FIGURES.

Pl. IV. Fig. 10*a*. The zoarium from the side; nat. size. Fig. 10*b*, part of the head; × 10 dia. Mantell Coll. **10,297.**

AFFINITIES.

This species resembles the clavate *Cerioporæ* (or cf. *C. digitalis*), but differs by the zonal structure due to the horizontal laminæ.

The clavate shape of the zoarium separates it from *Zonatula vinei*.

10,297. The type-specimen. Lower Greensand. Farringdon, Berkshire. Mantell Coll. Figd. Pl. IV. Fig. 10.

3. **Zonatula favus** (Seeley), 1866.

SYNONYMY.

Reptomulticava favus, Seeley, 1866. Foss. Hunstant.: Ann. Mag. Nat. Hist. ser. 3, vol. xvii. p. 181.
,, ,, Vine, 1891. Polyz. Red Chalk: Proc. Yorks. Geol. Soc. vol. xi. p. 383.
? *Ceriopora spongites*, Wiltshire, 1859. Red Chalk: Geol. 1859, p. 276.
? ,, ,, Seeley, 1861. Posit. Red Limestone: Ann. Mag. Nat. Hist. ser. 3, vol. vii. p. 243.
non Reptomulticava micropora, Vine, 1889. Polyz. Greensd.: Proc. Yorks. Geol. Soc. vol. xi. p. 258.
,, ,, Vine, 1890. Bry. Red Chalk: Quart. Journ. Geol. Soc. vol. xlvi. p. 480.
non ,, ,, Vine, 1891. Rep. Cret. Polyz.: Rep. Brit. Assoc. 1890, p. 384.
Ceriopora ,, Vine, 1891. Polyz. Red Chalk: Proc. Yorks. Geol. Soc. vol. xi. p. 382.
,, ,, Vine, 1891. Rep. Cret. Polyz.: Rep. Brit. Assoc. 1890, p. 396.
,, ,, Vine, 1892. Addit. Cret. Polyz.: Proc. Yorks. Geol. Soc. vol. xii. p. 152.
non ,, ,, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 334.
Zonopora irregularis, *non* d'Orb., Vine, 1890. Polyz. Red Chalk: Quart. Journ. Geol. Soc. vol. xlvi. p. 482.
,, ,, Vine, 1891. Polyz. Red Chalk: Proc. Yorks. Geol. Soc. vol. xi. pp. 383–4.
,, ,, Vine, 1891. Rep. Cret. Polyz.: Rep. Brit. Assoc. 1890, p. 396.
Heteropora ,, Vine, 1893. Compl. Rep.: *ibid.* 1892, p. 332.
Zonopora undata, Vine, 1891. Rep. Cret. Polyz.: *ibid.* 1890, p. 384.
,, ,, Vine, 1892. Addit. Cret. Polyz.: Proc. Yorks. Geol. Soc. vol. xii. p. 152, pl. vi. figs. 8, 9.
Heteropora ,, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 332.

DIAGNOSIS.

Zoarium of short, thick, cylindrical stems, with horizontal laminæ separating layers of crowded zoœcia. Young zoœcia grow in circular groups of short tubular zoœcia.

Apertures circular or slightly angular.

DIMENSIONS.

	mm.
Zoarium : length	7
Zoarium : diameter	3–4
Zoœcia : diameter	·2

DISTRIBUTION.

Red Chalk : Hunstanton.[1]

FIGURES.

Pl. IV. Fig. 9. Zoarium from the side ; × 6 dia. Red Chalk : Hunstanton. Jesson Coll. **D. 2057.**

AFFINITIES.

The specimen, **D. 2057**, taken to represent this species is the best preserved of a series of fragments from the Red Chalk, which have been described by Vine and referred to several species. It appears to be clearly a *Zonatula*, but the others are probably members of the same species, though their generic characters are not shown ; and they possibly include representatives of more than one species.

The species is in all probability the *Reptomulticava favus* of Seeley, although Vine retained that as a *Reptomulticava* (Proc. Yorks. Geol. Soc. 1891, vol. xi. p. 383). Professor Seeley's original description is brief. According to it the species is related to *R. collis* and *R. mamilla*, but is twice their size ; it is irregular in growth, and twice as high as wide ; the zoœcia are denser than in *R. collis* ; the walls are very thin ; the lower apertures are hexagonal, but at the upper part of the zoarium they are distant, round, and protuberant.

This description accords well with the chief characters recognizable in the following series of specimens.

LIST OF SPECIMENS.

D. 2057. A characteristic zoarium. Figured by Vine as *Zonopora irregularis*, d'Orb. Red Chalk. Hunstanton. Jesson Coll., No. 45. Figd. Pl. IV. Fig. 9.

D. 2045. A small zoarium, 9 mm. high and 4 mm. wide, embedded in Red Chalk. Red Chalk—Middle Bed. Hunstanton. Labelled by Vine *Ceriopora micropora* (?), Goldf., No. 34. The surface is not well preserved, and it is possibly heteroporous. Purchased T. Jesson, 1891.

D. 2046. Two stems of small zoaria, 4 mm. in diameter and 4 mm. high. Red Chalk—Middle Bed. Hunstanton. Labelled by Vine *Ceriopora micropora*, Goldf., var., No. 35. Purchased T. Jesson, 1891.

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[1] If Wiltshire's *C. spongites* is based on this species, the locality of Speeton must be added.

D. 2625. A small indeterminable fragment. Top bed of the Red Chalk. Hunstanton. Jesson Coll., No. 36. Identified and recorded by Vine as *Zonopora irregularis.*

D. 2663. A young zoarium, consisting of little more than a thick discoid base, with the surface well preserved. The apertures have slightly raised peristomes in the centre, and they are there separated by slight depressions; they are crowded around the lower edge. Labelled "*Zonopora undata.*" Red Chalk. Hunstanton. G. R. Vine Coll., No. 7. It is indeterminable, but is probably the young stage of the same species as **D. 2045**. The surface gives no evidence that the zoœcia are dimorphic.

D. 2664. Indeterminable fragment of an elliptical stem; walls of zoœcia moniliform near the aperture (probably the same species as **D. 2665**). Red Chalk. Hunstanton. G. R. Vine Coll.

D. 2665. An indeterminable fragment; a thin section has been cut from it and shows that it is dimorphic. Labelled "*Zonopora undata.*" Red Chalk. Hunstanton. G. R. Vine Coll., No. 7.

UNREPRESENTED SPECIES.

1. **cottaldina** (d'Orbigny), 1854.

Syn. *Zonopora cottaldina*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 87.
,, ,, d'Orbigny, 1853. Bry. Crét. p. 929, pl. 771, figs. 1–3.
,, ,, de Loriol, 1868. Mon. Valang. Arzier: Pal. Suisse, ser. 4, pt. ii. p. 64, pl. vi. fig. 3.
Heteropora arborea, *pars*, Pergens, 1890. Rev. p. 373.

Char.—Zoarium of thin cylindrical branches, 2 mm. in diameter; the branches have regular verticils of apertures, separated by internodes covered by mesopores. Each aperture has a raised rim.

Distrib.—Neocomian: Fontenoy and Auxerre, Yonne.
Valangian: Arzier, Vaud (Upper and Middle Beds of de Loriol).

2. **irregularis** (d'Orbigny), 1854.

Syn. *Zonopora irregularis*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 87.
,, ,, d'Orbigny, 1853. Bry. Crét. p. 930, pl. 771, figs. 4–6.
non ,, ,, Vine, 1890. Polyz. Red Chalk: Quart. Journ. Geol. Soc. vol. xlvi. p. 482.
non ,, ,, Vine, 1891. Microz. Red Chalk: Proc. Yorks. Geol. Soc. vol. xi. p. 383.
Heteropora arborea, *pars*, Pergens, 1890. Rev. p. 373.

Char.—Zoarium flabellate, with anastomosing branches, which are long and thin. Apertures in wedge-shaped groups, placed alternately along the branches. These groups are separated by bands of mesopores.

Distrib.—Neocomian[1]: Fontenoy and Auxerre, Yonne; Vassy and Baudrecourt, Haute-Marne.

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[1] One specimen from the Red Chalk, referred to this species by Vine, is the small fragment recorded above as *Zonatula favus*, **D. 2625**.

3. **lævigata** (d'Orbigny), 1850.

SYN. *Zonopora lævigata*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 141.
,, ,, d'Orbigny, 1853. Bry. Crét. p. 931, pl. 771, figs. 7, 8.

CHAR.—Zoarium flabellate, with branches on one plane, but not anastomosing. The branches are from 4 to 6 mm. in diameter. Apertures arranged in irregular, alternate bands.

DISTRIB.—Albian: Grandpré and Sance-au-Bois, Ardennes.

4. ? **variabilis** (d'Orbigny), 1853.

SYN. *Zonopora variabilis*, d'Orbigny, 1853. Bry. Crét. p. 931, pl. 771, figs. 9–13.
non ,, ,, ? Vine, 1890. Polyz. Red Chalk: Quart. Journ. Geol. Soc. vol. xlvi. p. 482.
non ,, ,, ? Vine, 1891. Microz. Red Chalk: Proc. Yorks. Geol. Soc. vol. xi. p. 384.
Heteropora ,, Pergens, 1890. Rev. p. 374.

CHAR.—Zoarium of thin branches, 2–3 mm. in diameter, which are dichotomous and do not anastomose. The branches are often very short and irregular. Apertures "of very irregular groups, more or less transverse." Mesopores, including half the walls, ·12 mm. in diameter. Zoœcia ·16 mm. in diameter.

DISTRIB.—Senonian—Maastrichtian: Royan, Charente-Inférieure.
Santonian: Saintes, Charente-Inférieure.
Coniacian: Lavardin and Villavard, Loir-et-Cher; Tours, Indre-et-Loire.

5. **undata** (d'Orbigny), 1853.

SYN. *Zonopora undata*, d'Orbigny, 1853. Bry. Crét. p. 932, pl. 771, figs. 14, 15.
non ,, ,, Vine, 1891. Rep. Cret. Polyz.: Rep. Brit. Assoc. 1890, p. 384.
Heteropora ,, Pergens, 1890. Rev. p. 374.
,, ,, Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 332.
,, *undulata*, Pergens, 1893. Bry. St. Pat.: Bull. Soc. belge Géol. vol. vi., Pr. Verb. p. 208.

CHAR.—Zoarium of dichotomous, non-anastomosing branches, 4 mm. in diameter. They have irregular, alternate, transverse elevations, on which the apertures are grouped. The zoarium has, therefore, a somewhat wavy surface. Apertures, internal diameter, ·12 mm. Mesopores, including half the walls, ·12 mm. in diameter.

DISTRIB.—Senonian: Bougniaux; St. Léger; Péguillac and Pérignac, in Charente-Inférieure.

AFF.—Vine has identified several specimens from the Red Chalk as this species. The specimens are small fragments; some of them appear to me quite indeterminable; they are recorded under *Zonatula favus*, to which they probably belong, **D. 2663**, **D. 2665**.

MULTIZONOPORA, d'Orbigny, 1853.

[Bry. Crét. p. 926.]

SYNONYMS.

Heteropora, *pars*, Koch & Dunker, 1837; Römer, 1839; Credner, 1864; Pergens, 1890.
Ceriopora, *pars*, Römer, 1839; d'Orbigny, 1850.
Zonopora, *pars*, d'Orbigny, 1850; Gregory, 1899.
Pustulopora, *pars*, Römer, 1839.
Spiroclausa, *pars*, de Loriol, 1863.
Multicavea, *pars*, de Loriol, 1863.

DIAGNOSIS.

Zonatulidæ in which the zoarium is dendroid and composed of many superimposed laminæ.

Apertures not confined to one surface of the zoarium, but occur in alternate, irregular bands or groups.

TYPE SPECIES.

Heteropora arborea, Koch & Dunker, 1837: Beitr. nordd. Ool. p. 56, pl. vi. fig. 14. The *H. ramosa*, Römer, 1839. Neocomian: Germany and France.

AFFINITIES.

This genus is allied to *Zonatula*, but differs from it by the lamellar structure of the zoarium.

1. **Multizonopora arborea** (Koch & Dunker), 1837.

SYNONYMY.

Heteropora arborea, Koch & Dunker, 1837. Beitr. nordd. Ool. p. 56, pl. vi. fig. 14.
,, ,, Römer, 1839. Verst. nordd. Ool., Nachtrag, p. 12, pl. xvii. fig. 17.
? ,, ,, Credner, 1864. Pter. Sch. Hann.: Zeit. deut. geol. Ges. vol. xvi. p. 242, pl. xi. fig. 1.
? ,, ,, Struckmann, 1878. Ob. Jura Hannover, p. 26.
,, ,, *pars*, Pergens, 1890. Rev. p. 373, fig. 6; p. 312.
non ,, ,, Canu, 1900. Bry. Tours: C.R. Assoc. franç. Av. Sci. 1899, p. 410.
Ceriopora ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 94.
Heteropora ramosa, Römer, 1840. Verst. nordd. Kr. p. 24.
[1] *non* ,, ,, Počta, 1892. Mech. Koryc. Hory: Ces. Ak. Fr. Jos. Praze, sect. ii. p. 24, pl. iii. figs. 1–6.
Multizonopora ramosa, d'Orbigny, 1853. Bry. Crét. p. 927, pl. 772, figs. 1–3.
,, ,, de Loriol, 1863. Invert. Néoc. moy. Mt. Salève, pt. ii. p. 140, pl. xvii. fig. 8.

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[1] A *Clausa* from the Cenomanian of Bohemia; *vide* Vol. I. p. 424.

Multizonopora ramosa, de Loriol, 1868. Mon. Valang. Arzier: Pal. Suisse, ser. 4, pt. ii. p. 64.

,, ,, Canu, 1902. Bry. foss. i., Coll. Camp.: Bull. Soc. géol. France, ser. 4, vol. ii. p. 11.

Heteropora (*Multizonopora*) *ramosa*, Keeping, 1883. Foss. Neoc. Upware, p. 141.

Pustulopora biformis, Römer, 1839. Verst. nordd. Ool., Nachtrag, p. 12, pl. xvii. fig. 20.

,, ,, Römer, 1840. Verst. nordd. Kr. p. 22.

Zonopora ,, ? Gregory, 1889. B.M. Cat. Cret. Bry. vol. i. p. 428.

? *Spiroclausa neocomiensis*, de Loriol, 1863. Invert. Néoc. moy. Mt. Salève, pt. ii. p. 137, pl. xvii. fig. 7.

Ceriopora polymorpha, Etheridge & Newton, 1878. Cat. Cret. Foss. Mus. Pract. Geol. pp. 6–7.

Heteropora (*Multicrescis*) *arbuscula*, Keeping, 1883. Foss. Neoc. Upware, p. 143, pl. vii. figs. 17*a*, *b*.

Multicavea neocomensis, de Loriol, 1863. Invert. Néoc. moy. Mt. Salève, pt. ii. p. 142, pl. xviii. figs. 1, 2.

Ceriopora subnodosa, Römer, 1839. Verst. nordd. Ool.: Nachtrag, p. 11, pl. xvii. fig. 19.

DIAGNOSIS.

Zoarium of branches from 3 to 10 mm. in diameter, which dichotomize in the same plane. The branches may be cylindrical or elliptical in cross-section. Surface often raised in round knobs or blunt elevations.

Apertures crowded and circular, distributed in irregular transverse bands, which may be confluent or separated by irregular transverse bands of mesopores. The zonal structure may be obscure in old stems.

DIMENSIONS.

	Koch & Dunker's type.	De Loriol.	B.M. D. 7087.
	mm.	mm.	mm.
Length of branches ...	30 (longest fragment)	60	25
Diameter of branches ...	3 to 5	4 to 9	from 9 × 7 to 16 × 12 at the base
Diameter of axial bundle ...	—	not quite half the diameter of the stem	—
Diameter of apertures ...	about ·2	about ·2	·2
Diameter of mesopores ...	about ·06	about ·1	·1

DISTRIBUTION.

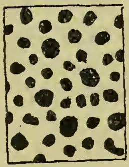
BRITISH:

Lower Greensand: Upware, Brickhill.

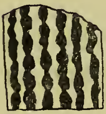
FOREIGN:

Neocomian—Hauterivian: Elligser Brink, near Liebenburg; Schöppenstedt, Schandelahe, and Delligsen, in Brunswick; Goslar, near Harz; Ste. Croix, Vaud; La Varappe and La Croisette, Mt. Salève; Fontenoy, Auxerre, St. Sauveur, and St. Puis, Yonne; Vassy, Baudrecourt, and St. Dizier, Haute-Marne; Cressier, near Neuchatel.

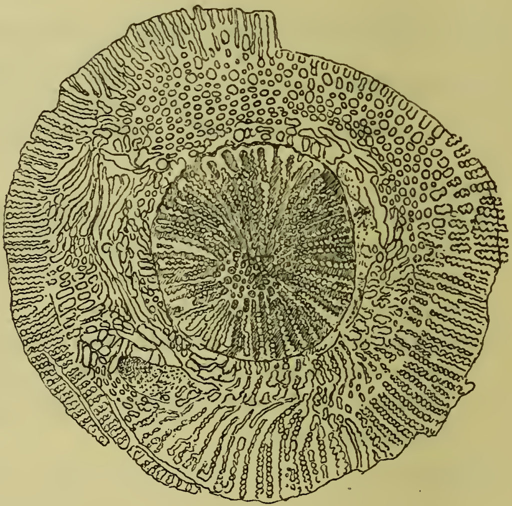
? Upper Kimmeridgian—*Pteroceras virgula* beds: Tönjesberg and Ahlem, Hanover.



57



58



59

Multizonopora arborea.

FIG. 57.—Transverse section; × 10. **D. 7087.**

FIG. 58.—Vertical section; × 10. **D. 7087.**

FIG. 59.—Transverse section; × 10. **D. 3654.**

FIGURES.

Fig. 57. A transverse section showing the apertures and single circles of mesopores; × 10 dia. Neocomian: Goslar, Hanover. Krantz Coll. **D. 7087.**

Fig. 58. Part of a vertical section from the same specimen, showing the moniliform walls of the zoœcia; × 10 dia. Neocomian: Goslar, Hanover. Krantz Coll. **D. 7087.**

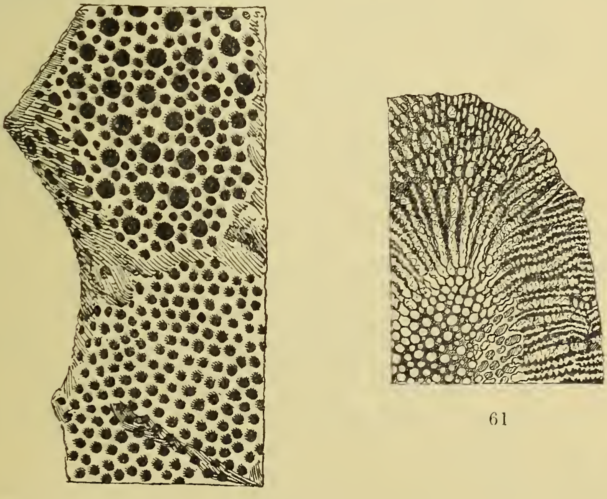
Fig. 59. Part of a transverse section; × 10 dia. Neocomian: Berklingen. **D. 3654.**

Fig. 60. Part of the surface of a zoarium of var. *subnodosa*, showing one band with only mesopores ; × 10 dia. Neocomian : Berklingen. **D. 3652.**

Fig. 61. Part of a section across the same specimen ; × 10 dia. Neocomian : Berklingen. **D. 3652.**

Affinities.

The first difficulty with this species is due to the fact that Koch & Dunker's figure does not show the zonal arrangement of the apertures and mesopores. That their species was dimorphic is evident from their description, "poris creberrimis majoribus et minutissimis." Römer promptly referred a zonal form to this species, and he has been followed by later authors. That this course is correct is most probable, as some of the Museum specimens show the zonal structure only in parts of the zoarium, and even in these places very imperfectly (as in **D. 7087**), though in others it is quite distinct.



60

61

Multizonopora arborea, var. *subnodosa*.

Fig. 60.—Part of surface of zoarium ; × 10. **D. 3652.**

Fig. 61.—Transverse section ; × 10. **D. 3652.**

Examination of the specimen **D. 3650** has led me to the view that the *Pustulopora biformis* of Römer is a synonym of this species. Römer's fig. 20*c* shows a well-marked zonal arrangement of the apertures, and leads me to include the species doubtfully in *Multizonopora.*

Römer's *Ceriopora subnodosa* appears also to be a form of this species; he figured part of a worn stem which contained only the apertures belonging to one zone of the stem.

Keeping's *H. arbuscula* is probably the same species; he remarks the zonary arrangement of its apertures, and he includes in his species a specimen previously catalogued as *Ceriopora polymorpha* of Goldfuss.

LIST OF SPECIMENS.

D. 3644. Two branches of var. *subnodosa.* One is 27 mm. long, 7 mm. in diameter near the base, and 5 mm. in diameter near the top. The branches are slightly compressed in section. The surface is nodose, which gives it somewhat the aspect of a *Nodicrescis.* The bands of mesopores are narrower than in **D. 3652.** Neocomian — Hilsconglomerat. Berklingen, Brunswick. Saemann Coll.

D. 3650. A branch of the var. *biformis*, 18 mm. long, 4 mm. in diameter at the base, and 3 mm. above. The linear arrangement of the apertures is distinct. Neocomian—Hilsconglomerat. Berklingen. Saemann Coll.

D. 3652. A zoarium of the var. *subnodosa* (Röm.) and a section from the same. The branches are all in one plane, and are laterally compressed; the larger branches are 6 × 4·5 mm. in diameter, the smaller 4 × 3 mm. in diameter. The areas of mesopores are wider than in **D. 3654**, or in that shown in Römer's figure; it thus presents an intermediate stage to *C. subnodosa.* Neocomian—Hilsconglomerat. Berklingen, Brunswick. Saemann Coll. Figs. 60, 61, p. 223.

D. 3654. Three irregular zoaria; one of which is growing attached to a sponge. The largest is 35 mm. high, 13 mm. in diameter at the base, and has stems 9 mm. in diameter, which taper to 8 × 7 mm. near the top. The growth of the branches is very irregular. The structure is like *Heteropora*, with single circles of large mesopores around the apertures. In the upper part of the stems there are narrow zonal bands of mesopores. Also a section of the same. Neocomian—Hilsconglomerat. Berklingen, Brunswick. Saemann Coll. Fig. 59, p. 222.

? **D. 3655.** Two dichotomous stems, one 38 mm. long and the other 28 mm. long. The shorter branch is the better preserved; it is 8 mm. in diameter at the base; is 4 mm. in diameter above the fork; and shows the occurrence of both mesopores and normal zoœcia, while in the upper part of the stem there are areas occupied by mesopores only. The longer branch is less well preserved; the stem is 4–6 mm. in diameter, and is laterally compressed; its branches are not quite in the same plane. Neocomian. Censeau, near Salins, Jura. Saemann Coll. Labelled by Saemann *Ceriopora tuberosa.*

? **D. 3661.** A badly preserved stem, 16 mm. long, which may belong to this species. Hauterivian. Cressier, near Neuchatel. Bruckmann Coll.

D. 7087. The base of an elliptical zoarium. Base, 16 mm. × 12 mm.; height, 25 mm.; stem above base, 10 mm. diameter; above the fork, 9 mm. × 7 mm. diameter. This, being the base of an old thick specimen, shows the zonal arrangement of apertures and mesopores very imperfectly developed. Neocomian. Goslar, near Harz, Hanover. Purchased Dr. F. Krantz, 1898. Figs. 57, 58, p. 222.

2. **Multizonopora? magnifica** (Novak), 1877.

SYNONYMY.

Heteropora magnifica, Novak, 1877. Bry. böhm. Kr.: Denk. Ak. Wiss. Wien, vol. xxxvii. Abt. ii. p. 115, pl. ix. figs. 1, 2.
,, ,, Frič, 1883. Isersch.: Arch. Naturw. Landesf. Böhm. vol. v. pt. ii. p. 127, fig. p. 126.

DIAGNOSIS.

Zoarium with long, thin, cylindrical or flattened, dichotomously branching stems, about 3–4 mm. in diameter. Apertures large, subcircular to elliptical, in ill-defined irregular groups. The mesopores are subangular or circular.

DISTRIBUTION.

Turonian — Iser-Schichten: Trigonia beds at Brandeis, Bohemia; and Rovensko.

AFFINITIES.

The relations of this species are uncertain. The two fragments in the Museum Collection are imperfectly preserved; most of the fossil is silicified, and the structure retained only in places; but these patches show large areas of mesopores, with the apertures apparently confined to transverse bands, though this character is not certainly established by the specimens. The hollow character of one specimen, some indication of lamination, and the arrangement of the apertures render it probable that the species is a *Multizonopora*. If so, it is most nearly allied to *M. ligeriensis*, d'Orb., which differs by having stouter branches and more regular groups of apertures.

D. 4439. Two long, thin, dichotomous branches, one of which is partly hollow. Turonian—Iser-Schichten. Brandeis am Adler, Bohemia. Purchased of Dr. Anton Frič. One branch is 27 mm. long and 3–4 mm. in diameter at the stoutest part; it is circular and 2·5 mm. in diameter near the end; the other branch is 22 mm. long and 3 × 2·5 mm. in diameter.

3. **Multizonopora ligeriensis**, d'Orbigny, 1853.

SYNONYMY.

Multizonopora	*ligeriensis*,	d'Orbigny, 1853. Bry. Crét. p. 927, pl. 772, figs. 1-6.
Heteropora	,,	Pergens, 1890. Rev. p. 374.
,,	,,	Pergens, 1893. Bry. St. Pat.: Bull. Soc. belge Géol. vol. vi., Pr. Vb. p. 208.
non ,, (*M.*)	,,	Vine, 1893. Compl. Rep.: Rep. Brit. Assoc. 1892, p. 311.
,,	,,	Canu, 1900. Géol. Romorantin: Bull. Soc. géol. France, ser. 3, vol. xxviii. p. 102.
Zonopora	,,	Canu, 1903. Faune Craie Villedieu: *op. cit.* ser. 4, vol. iii. p. 266.

DIAGNOSIS.

Zoarium of long, thick branches, 3–12 mm. in diameter. The branches dichotomize and their surface is slightly pustular.

Apertures in alternate bands, which are sometimes wedge-shaped and sometimes irregular; the bands may contain up to three rows of apertures. Broad intervening areas occupied by mesopores.

DISTRIBUTION.

Senonian—Santonian: Romorantin, Loir-et-Cher.
Coniacian: Vendôme, Villedieu, and Lavardin, Loir-et-Cher; St. Paterne, Tours, and St. Christophe, Indre-et-Loire; Fontevrault, Marne-et-Loir.

D. 4000. Fragment on slide. Senonian. St. Paterne. Purchased F. Gamble, 1898. Identified by M. Pergens.

BIVESTIS, Hamm, 1881.

[Bry. mastr. Ob.-Sen. i., Cycl. p. 37.]

DIAGNOSIS.

Zonatulidæ with a zoarium of erect, branched stems, which consist of zoœcia arranged in two different layers; one series forms a vertical sugar-loaf-shaped group, which is surrounded, like a mantle, by a layer composed of other zoœcia.

The zoœcia are dimorphic, and the two types are arranged in irregular groups. Apertures irregularly arranged, and the separate apertures are flush with the surface.

TYPE SPECIES.

Bivestis macropora, Hamm. Senonian—Maastrichtian: Ciply.

AFFINITIES.

As this genus includes Zonatulidæ, in which the stems have the pores arranged in groups in oblique depressions, it is apparently a near ally of *Zonatula.* It differs from that genus by its bilaminar structure, and is therefore nearer to *Multizonopora,* of which it may be a synonym.

UNREPRESENTED SPECIES.

macropora, Hamm, 1881.

SYN. *Bivestis macropora*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 37.

CHAR. — Zoarium of large, dichotomous, cylindrical branches. The larger apertures are somewhat triangular, with rounded angles. The smaller ones open in narrow, obliquely elongate areas, which are mostly slightly depressed. The smaller pores are a third to a fourth the diameter of the larger.[1]

DISTRIB.—Senonian—Maastrichtian: Ciply, Folx-les-Caves, Belgium.

PLETHOPORA, von Hagenow, 1851.

[Bry. maastr. Kr. p. 45.]

SYNONYMS.

Pledopora, von Hagenow, 1850.
Plethopora, d'Orbigny, 1854; Winkler, 1864; Ubaghs, 1879; Ulrich, 1900.
Ceriopora, *pars*, Morren, 1829; von Hagenow, 1846 and 1851.
Corymbosa, *pars*, d'Orbigny, 1853.
Fasciculipora, *pars*, Hamm, 1881.
Sparsicytis, *pars*, Filliozat, 1908.

DIAGNOSIS.

Zonatulidæ with a zoarium of short, thick stems, with the apertures collected into groups, which project in knobby elevations above the general level of the surface. The groups of apertures are separated by wide areas covered with mesopores.

TYPE SPECIES.

Plethopora verrucosa, von Hagenow, 1851: Bry. maastr. Kr. p. 45, pl. v. fig. 10. This species is especially mentioned by von Hagenow as the type. Maastrichter Kalk: Maastricht.

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[1] Each large aperture is described by Hamm as surrounded by a circle of intermediate pores (*Zwischenporen*). Whether these are the same as the smaller *Zellöffnungen* is not clear.

AFFINITIES.

This genus differs from *Multizonopora* by the structure of the zoarium not being multilamellar; the apertures tend to occur in elliptical or circular raised groups instead of in bands.

1. **Plethopora verrucosa,** von Hagenow, 1851.

SYNONYMY.

Plethopora verrucosa, von Hagenow, 1851. Bry. maastr. Kr. p. 45, pl. v. fig. 10.
,, ,, Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 208.
,, ,, Ubaghs, 1867. Descr. Géol. Pal. Limb. p. 226.
Fasciculipora prolifera, *pars*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 35.
Pledopora truncata, von Hagenow, 1850. In Geinitz, Quadersandsteingeb. p. 242.
Plethopora ,, von Hagenow, 1851. Bry. maastr. Kr. p. 46, pl. v. fig. 11.
,, ,, Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 208.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 226.
Corymbosa ,, d'Orbigny, 1853. Bry. Crét. p. 690.
Plethopora verrucosa, *pars*, d'Orbigny, 1854. Bry. Crét. p. 1045.
Ceriopora vibicata, von Hagenow, 1846. In Geinitz, Grundr. Verst. vol. ii. p. 599, pl. xxiii B, fig. 17.
Plethopora ,, von Hagenow, 1851. Bry. maastr. Kr. p. 45.
,, *ulcerosa*, von Hagenow, 1851. *Ibid.*
,, *malmi*, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 31, pl. ii. fig. 30, and fig. 19, p. 31.

DIAGNOSIS.

Zoarium of thick, short, simple stems, which may bifurcate into lobe-like branches. The groups of apertures are circular, or elliptical, or sometimes occur as irregular bands.

DIMENSIONS.

	Von Hagenow's type.	Hennig's *P. malmi*.
	mm.	mm.
Height of zoarium	17 ...	15
Diameter of zoarium	4–5 ...	2–5
Diameter of tufts	2 ...	1·5–2
Diameter of apertures	·1 ...	·06–·1
Diameter of mesopores	·06 ...	—

DISTRIBUTION.

Senonian—Maastrichtian: Maastricht; Falkenberg.
Campanian—Zone of *Belemnitella mucronata* (beds with *Actinocamax mamillatus*): Balsberg and Oppmanna, Sweden.

AFFINITIES.

This species is the type of genus. D'Orbigny at first placed *P. truncata* in the genus *Corymbosa*. The *P. malmi* of Hennig appears to me a typical specimen of *P. verrucosa*, and its occurrence and characters suggest that von Hagenow's *ulcerosa* and *vibicata* from the Senonian of Scania are both synonyms of this species. If this view be established, then the name *vibicata* has priority; but the figures and description were so poor that it is best to leave that species as inadequately founded.

LIST OF SPECIMENS.

D. 3766. A fragment 8 mm. long and 3 mm. in diameter. The areas between the apertures are covered by a dense epizoarial layer. Maastrichter Kalk. Maastricht. Gamble Coll. Identified by M. Pergens.

D. 1343. A forked stem (on slide), 16 mm. long and 3–5 mm. in diameter; it is hollow in places. Maastrichter Kalk. Maastricht. Vine Coll.

D. 1342. A stem-fragment, 5 mm. long and from 2½ to 3 mm. in diameter. Maastrichter Kalk. Maastricht. Vine Coll.

D. 3776. A fragment, 4 mm. long, of a stem 2 mm. in diameter; the structure is essentially the same as in *Zonatula pseudotorquata*, and the closure of the zoœcia is clearly due to the overgrowth of the apertures of the oblique zoœcia by a calcareous layer, deposited after the death of the zoœcia. Maastrichter Kalk. Maastricht. Gamble Coll. Identified by M. Pergens.

? D. 3329. A stem, probably of the form of the *Ceriopora vibicata* of von Hagenow. The apertures occur in the lower part in horizontal rows; in the upper part the apertures are in groups of two or three, and stand out in small elevations. Maastrichter Kalk. Maastricht. Old Coll.

2. **Plethopora arbuscula** (Filliozat), 1908.

SYNONYMY.

Sparsicytis arbuscula, Filliozat, 1908. Bry. Crét. Vendôme: Bull. Soc. géol. France, ser. 4, vol. vii. p. 399, pl. xiv. fig. 6.

DIAGNOSIS.

Zoarium of thin cylindrical branches, up to 1 mm. in diameter. They may be straight or slightly bent. The tufts bearing the apertures project for a length of from a third to half the diameter of the stems. The apertures are collected in oval groups. Apertures crowded, and may be subangular. About ·06 to ·1 mm. in diameter. Mesopores about one-half the diameter of the zoœcia.

DISTRIBUTION.

Senonian—Coniacian: Villavard (Craie marneuse); Les Roches, St. André, and Villers, Loir-et-Cher (Zone of *Crania ignabergensis*).

FIGURES.

Pl. VI. Fig. 1*a*. A zoarium from the side; × 5 dia. Fig. 1*b*, part of the same; × 18 dia. Senonian — Craie marneuse: Villavard, Loir-et-Cher. **D. 4924.**

AFFINITIES.

This species is a very close ally of *P. verrucosa*, which has thicker and less regular branches.

D. 4924. A zoarium (on slide). Senonian—Craie marneuse. Villavard, Loir-et-Cher. Purchased of F. H. Butler.

UNREPRESENTED OR DOUBTFULLY REPRESENTED SPECIES.

? mammillifera (Morren), 1829.

SYN. *Ceriopora mammillifera*, Morren, 1829. Corall. Foss. Belg.: Ann. Acc. Groning, 1828, p. 42.

"Milleporite," Faujas-St. Fond, 1799. Hist. Nat. Mont. St. Pierre, p. 206, pl. xl. figs. 2*a*, *b*.

CHAR.—Massive, nodular, hollow, tapering to an apex. Pores minute (*minutissimus*, *fide* Morren). Zoœcia in tufts in scattered groups.

DISTRIB.—Senonian—Maastrichtian: Maastricht.

AFF.—The occurrence of the minute pores recorded by Morren suggests that this species is a *Plethopora*. If multilamellar in structure, it may be the same as *Polyphyma bulbosa* of Hamm.

SPARSICYTIS, Filliozat, 1908.

[Bry. Crét. Vendôme: Bull. Soc. géol. France, ser. 4, vol. vii. p. 398.]

DIAGNOSIS.

Zonatulidæ with the zoarium arborescent and consisting of sub-cylindrical branches. The apertures of the zoœcia open on prominences, which are elongated horizontally across the stems. The raised groups are separated by areas covered with mesopores.

TYPE SPECIES.

Plethopora cervicornis, d'Orbigny. Senonian: France.

AFFINITIES.

This genus is a close ally of *Plethopora*, from which it differs by the groups of apertures being elongated transversely instead of being oval. This difference is lessened by the occasional elongation of some of the groups in *Plethopora*, as in von Hagenow's type of *P. verrucosa* (von Hagenow, Bry. maastr. Kr. pl. v. fig. 10*b*).

UNREPRESENTED SPECIES.

1. cervicornis (d'Orbigny), 1850.

SYN. *Monticulipora cervicornis*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 279.
Plethopora ,, d'Orbigny, 1854. Bry. Crét. p. 1045, pl. 799, figs. 4, 5.
Sparsicytis ,, Filliozat, 1908. Bry. Crét. Vendôme: Bull. Soc. géol. France, ser. 4, vol. vii. p. 398.

CHAR.—Apertures collected along conspicuous transverse crests.

DISTRIB.—Senonian—Coniacian: Tours, Indre-et-Loire.[1]

2. concava, Filliozat, 1908.

SYN. *Sparsicytis concava*, Filliozat, 1908. Bry. Crét. Vendôme: Bull. Soc. géol. France, ser. 4, vol. vii. p. 399, pl. xiv. fig. 5.

CHAR.—Zoarium with irregularly bent stems, 2 mm. in diameter. The lateral tufts are elongated transversely, being about twice as long horizontally as they are wide.

DISTRIB.—Senonian—Coniacian: Vendôme (Zone of *Crania ignabergensis*), Loir-et-Cher.

POLYPHYMA, Hamm, 1881.

[Bry. mastr. Ob.-Sen. i., Cycl. p. 38.]

DIAGNOSIS.

Zonatulidæ with a nodular, multilamellar zoarium, with a knob-bearing upper surface. The zoœcia are short, unequal in size, and arranged in round and somewhat knob-like, raised groups. The apertures are largest and quincuncially arranged in the middle of the knobs, and they gradually become smaller towards the sides.

TYPE SPECIES.

Polyphyma bulbosa, Hamm. Maastrichtian: Maastricht.

AFFINITIES.

Hamm places this genus in his Cerioporina, after the genus *Zonatula*. The zoœcia appear to be dimorphic. The multilamellar structure is conspicuous. It may be regarded as a multilamellar *Plethopora*.

UNREPRESENTED SPECIES.

bulbosa, Hamm, 1881.

SYN. *Polyphyma bulbosa*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 38.

CHAR.—Zoarium simple and like a flattened tuber. Apertures in the middles of the knobs, quincuncial, and separated by very thick walls. Zoœcia very short and wide.

DISTRIB.—Senonian—Maastrichtian: Maastricht.

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[1] The locality given by d'Orbigny in 1850 was Royan, a Maastrichtian horizon, but it was not repeated by d'Orbigny in 1854.

Family RADIOPORIDÆ.

SYNONYMS.

Caveidæ, *pars*, d'Orbigny, 1853.
Cerioporidæ, *pars*, Busk, 1859; *pars*, Simonowitsch, 1871.
Diastoporidæ, *pars*, Busk, 1859.
Lichenoporidæ, Smitt, 1867, 1872, 1873, 1878; Hincks, 1884; Vine, 1885; Pergens & Meunier, 1886; *pars*, Ulrich, 1900.
Discoporellidæ, Busk, 1875; *pars*, MacGillivray, 1887, 1895.
Radioporidea, *pars*, Marsson, 1887.

DIAGNOSIS.

Trepostomata with dimorphic zoœcia. The normal zoœcia are arranged in radial rows separated by series of mesopores.

The zoarium is simple and discoid, or turbinate, or fungiform, or massive and multilamellar, or composed of blunt multilamellar stems.

AFFINITIES.

This family is closely allied to the Heteroporidæ, from which it differs by the radial arrangement of the zoœcia.

The genera form a long series, from the simple adnate discoid *Discocavea*, to zoaria with branched cylindrical stems composed of many superposed discs as in *Tholopora*, and to the massive growths of *Radiopora*. The family begins in the Cretaceous, and during the same period attained its maximum; it still survives, being represented by *Tholopora*, *Lichenopora*, and *Discocavea*.

DISCOCAVEA, d'Orbigny, 1853.

[Bry. Crét. p. 957.]

SYNONYMS.

Madrepora, *pars*, Linnæus, 1768; Fabricius, 1780.
Melobesia, Audouin, 1826.
Discopora, *pars*, Fleming, 1828; de Blainville, 1830, 1834; Lamarck, 1816.
Tubulipora, *pars*, Lamarck, 1816; Milne-Edwards, 1837; Johnston, 1838; Gray, 1848; etc.
Lichenopora, *pars*, Michelin, 1846; d'Orbigny, 1851; Hincks, 1880; *pars*, Waters, 1884, 1887; Vine, 1885; Pergens, 1890; Počta, 1892; Harmer, 1896; *pars*, Ulrich, 1900.
Disporella, Gray, 1848.
Defrancia, *pars*, von Hagenow, 1851; d'Orbigny, 1851; *pars*, von Reuss, 1872, 1873.
Unicavea, *pars*, d'Orbigny, 1853.
Paricavea, d'Orbigny, 1854.
? *Radiopora*, *pars*, d'Orbigny, 1854; Simonowitsch, 1871.

Domopora, pars, d'Orbigny, 1854 ; Hamm, 1881
Heteroporella, pars, Busk, 1859 ; Hincks, 1861 ; von Reuss, 1872–3.
Discosparsa, Heller, 1867.
Discoporella, Busk, 1859, 1875.
,, (*Discocavea*), Pergens, 1890.
Semimulticavea, pars, Hamm, 1881.

DIAGNOSIS.

Radioporidæ in which the zoarium consists of discoid groups; they are usually single, but a few groups may unite into a loose compound mass.

Apertures, in radial, uniserial lines, separated by mesopores.

TYPE SPECIES.

Discocavea irregularis, d'Orbigny, 1854 : Bry. Crét. p. 961 ; named on pl. 645, figs. 9–12, 1851, as *Lichenopora irregularis*. Senonian : France.

This species is selected as type of the genus, none having been previously chosen from the eleven species included by d'Orbigny in the genus. *Discocavea neocomiensis*, the first in order of the species which d'Orbigny described, is unsuitable, as according to M. Pergens (Rev. p. 384) the type is lost.

AFFINITIES.

This genus differs from *Lichenopora*, as the apertures are arranged in uniserial lines and not in elliptical groups. It therefore includes many recent Bryozoa, which are often named *Lichenopora* ; but, as is explained on p. 246, *Lichenopora* was founded on a conical Eocene species, which is very different from the recent Bryozoa often referred to the genus.

The recent species should not retain the name *Lichenopora*. Busk recognized this fact, and named them *Discoporella*. But that name was only founded in 1859, and is therefore later than *Discocavea*. The only names founded on recent Bryozoa that appear to have any claim to adoption are *Melobesia* and *Disporella*. *Melobesia* appears a possible name, as it was applied by Audouin[1] in 1826 to the species *radiata*, of which a fine figure had been given by Savigny[2]; and as Audouin then remarked that the *Melobesia* of Lamouroux was very badly figured and defined, it may be suggested that the genus should be accepted as used by Audouin. But this view has not been adopted, and appears unnecessary. *Melobesia* was founded by Lamouroux on one species, *Melobesia pustulata*, Lamx.,[1] that grows attached to algæ on the coasts of France. The original figure suggests that the Bryozoon is a *Berenicea*, for neither the figure nor the description refers to that radial arrangement of the apertures which is the most conspicuous feature of *Lichenopora* and *Discocavea*. Moreover, all the apertures shown in Lamouroux's figure are of equal size. *Melobesia* is therefore not the same as *Discocavea*.

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[1] Explic. des Planches, Descript. de l'Égypte: Hist. Nat. vol. i. p. 235.

[2] J. C. Savigny. Descript. de l'Égypte: Hist. Nat. tom. ii, Planches, Polypes, pl. vi. fig. 3, Nos. 2–4.

Disporella of Gray was used by him in 1848[2] for a section of the genus *Tubulipora*, including the species *Tubulipora hispida* (Flem.); he described it as being "orbicular, edge thin, tubes in radiating ridges." But he did not use this name as that of either a genus or subgenus. It does not appear in that work in the list of genera and species (p. xiii), nor is it in the list of "the families and genera proposed in this catalogue" (pp. 144–9).

Gray's name, therefore, does not date from 1848,[3] but from its use in the form of *Discoporella* by Busk in the "Crag Polyzoa," 1859. The *Heteroporella* of Busk (1859) was founded for two Crag species, of which the first (*H. radiata*) is a typical *Discocavea*; the second (*H. parasitica*) is a *Heteropora*.

1. **Discocavea irregularis** (d'Orbigny), 1851.

SYNONYMY.

Lichenopora irregularis, d'Orbigny, 1851. Bry. Crét. pl. 645, figs. 9–12.
,, ,, Gamble, 1896. Cat. Bry. Chatham, p. 5.
,, ,, Canu, 1900. Bry. Tours: C.R. Assoc. franç. Av. Sci. 1899, p. 410.
,, (*Discocavea*) *irregularis*, *pars*, Pergens, 1890. Rev. p. 382.
Discocavea irregularis, d'Orbigny, 1854. Bry. Crét. p. 961.
Radiopora francqana, d'Orbigny, 1854. *Ibid.* p. 997, pl. 782, figs. 3–8.
Semimulticavea francqana (?), Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 41.
Actinopora collis, d'Orbigny, 1851. Bry. Crét. pl. 643, figs. 1–4.
Unicavea collis, d'Orbigny, 1854. *Ibid.* p. 973, pl. 778, figs. 1, 2.

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[1] J. Lamouroux. Expos. méth. Polypiers, 1821, pp. 45–6, pl. lxxiii. figs. 17, 18.

[2] J. E. Gray. "List of British Animals in the Collection of the British Museum. Pt. i. Centroniæ or Radiated Animals," 1848, p. 138.

[3] Gray used *Discopora*, Lam., in 1848, for a genus having the type species *D. verrucosa* (Esper), one of the Cheilostomata.

non Heteroporella collis, von Reuss, 1872–3. Bry. unt. Quad.: Palæontogr. vol. xx. pt. i. p. 133, pl. xxxiii. fig. 6.
Defrancia reticulata, von Hagenow, 1851. Bry. maastr. Kr. p. 43, pl. iv. fig. 3 (*non* fig. 4 as erroneously in text and description of plate).
,, ,, Kade, 1852. Los. Verst. Schanzenb. p. 31.
Discocavea ,, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv. p. 40.
non Radiocavea reticulata, d'Orbigny, 1853. Bry. Crét. p. 965 (on Goldf. figs. 12*a*, *b*, *c*, not *d*, *e*, *f*, and on Hag. pl. iv. fig. 4).
,, ,, ,, Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 11.
,, *Domopora* ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 43.
? ,, *cochloidea* (*non* Hag.), d'Orbigny, 1854. Bry. Crét. p. 990, pl. 781, figs. 5–7.
Paricavea perforata, d'Orbigny, 1854. *Ibid.* p. 986, pl. 780, figs. 11–14.
Lichenopora perforata, Pergens, 1890. Rev. p. 383.

DIAGNOSIS.

Zoarium elliptical or circular; thick, with a rounded, convex upper surface, in the centre of which is a well-marked depression.

Apertures in well-raised rows, which are short and contain from four to eight apertures in each row. Mesopores uniserial to triserial at the outer margin.

DIMENSIONS.

	D'Orbigny's type.	B.M. 50,468.	B.M. D. 2757.
	mm.	mm.	mm.
Diameter of zoarium ...	3 × 2·5	4·5 × 3·7	3·5 × 3·0
Thickness of zoarium ...	·8	1	1
Diameter of apertures ...	—	·07	·07–·08

DISTRIBUTION.

BRITISH:

Upper Chalk: Bromley, Kent; on *Echinocorys scutatus*, Broadstairs.
Zone of *Belemnitella mucronata*: Clarendon, near Salisbury.
Middle Chalk—Zone of *Micraster cortestudinarium*: Chatham.

FOREIGN:

Senonian—Maastrichtian: Maastricht; Ste. Colombe, Manche; ? Perignac, Charente-Inférieure.
Campanian: Meudon, near Paris.
Santonian: Saintes.
Coniacian: Les Roches, Lisle, Villedieu, and Vendôme, Loir-et-Cher; Joué and Tours, Indre-et-Loire.
Zone uncertain: Merpins, Charente.

FIGURES.

Pl. I. Fig. 8*a*. A zoarium with a well-developed thin selvage; × 10 dia. Fig. 8*b*, the same zoarium from the side; nat. size. Middle Chalk — zone of *Micraster cortestudinarium*: Chatham. Vine Coll. **D. 2757.**

Pl. I. Fig. 9*a*. A thick zoarium without the thin selvage, attached to a fragment of *Micraster* sp.; × 7 dia. Fig. 9*b*, the same zoarium from the side; nat. size. Chalk: Loc. ? (south-east of England). Morris Coll. **50,468.**

AFFINITIES.

This species, as pointed out by Marsson, was wrongly numbered on von Hagenow's plate. The latter's description, with its emphasis on the uniserial lines of round apertures, makes it obvious that *Defrancia reticulata* is the fossil shown on pl. iv. fig. 3, and not fig. 4 as printed. Owing to the confusion thus introduced, it is better to adopt d'Orbigny's name, which was published the same year. This course is all the more advisable as von Hagenow's *D. reticulata* was a very worn and imperfect specimen.

Paricavea appears to be a zoarium which has grown round a cylindrical stem. M. Pergens remarked on the resemblance between d'Orbigny's type of *P. perforata* and *D. irregularis*, but kept them distinct, as the diameter of the apertures in the former is ·04 mm. and in the latter ·06 mm.

LIST OF SPECIMENS.

BRITISH.

D. 2757. A zoarium with broad, well-preserved selvage (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll. Figd. Pl. I. Figs. 8*a*, *b*.

50,468. A thick zoarium, with belt of crowded lateral zoœcia growing on a fragment of *Micraster* sp. Chalk. Loc. (? south-east of England). Morris Coll. Figd. Pl. I. Figs. 9*a*, *b*.

B. 805. A zoarium with *Proboscina anomala*, Reuss, on *Echinocorys scutatus*, Leske. Upper Chalk. Broadstairs. Presented by Mrs. Burnett.

D. 2755. A small isolated zoarium (on slide, with *Porosphæra* sp.). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll.

D. 3008. An irregular zoarium attached to fragment of *Echinocorys scutatus*, Leske (on slide). Upper Chalk. Bromley. J. Simmons Coll.

D. 4230. A zoarium on echinoid plate. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

D. 4325. A zoarium on a Brachiopod. Upper Chalk—zone of *Belemnitella mucronata*. Clarendon, near Salisbury, Wilts. Gamble Coll.

D. 4584. A small zoarium on fragment of *Echinocorys* (on slide). Upper Chalk. England. Loc.? Morris Coll.

D. 7278. Two zoaria attached to fragments of *Echinocorys scutatus*, Leske. Upper Chalk. South of England. Purchased of F. H. Butler.

FOREIGN.

D. 3430. One zoarium. Maastrichter Kalk. Maastricht. Van Breda Coll.

2. **Discocavea reussi,** Gregory, 1909.

SYNONYMY.

Heteroporella collis (*non* d'Orb.), von Reuss, 1872. Bry. unt. Quad.: Palæontogr. vol. xx. pt. i. p. 133, pl. xxxiii. fig. 6.

Discocavea reussi, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 64.

DIAGNOSIS.

Zoarium small, circular, convex, with a small central depression, on the floor of which are about fifteen apertures. Radial series of apertures numerous and crowded, separated by only very narrow interradial furrows. About seven apertures in each ray. Apertures large.

DISTRIBUTION.

Cenomanian—Lower Quader: Gamighügel, near Dresden; Kahlebusch, near Dohna, Saxony.

AFFINITIES.

This species is most nearly allied to *Discocavea irregularis*, d'Orbigny, from which it differs by the insignificance of the interradial furrows.

D. 4466. Sixteen specimens (in tube). Cenomanian—Lower Quader. Kahlebusch, near Dohna, Saxony. Presented by Dr. H. Credner, 1898.

3. **Discocavea longiradiata,** Gregory, 1909.

SYNONYMY.

Discocavea longiradiata, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 65.

DIAGNOSIS.

Zoarium large, thin, circular. Zoœcia very numerous; apertures occurring in numerous long radial series, each containing from about ten to sixteen apertures. No selvage. Interradii very narrow.

DIMENSIONS.

Diameter of zoarium	6 × 8·5 mm.
Number of radii	40
Number of apertures in each radius	10–16
Diameter of aperture	·08–·1 mm.

Distribution.

Lower Chalk: Southeram Pit, near Lewes.

Figures.

Pl. I. Fig. 10*a*. The type-specimen; × 3 dia. Fig. 10*b*, part of the same; × 10 dia. Lower Chalk: Southeram Pit, near Lewes. Capron Coll. **D. 4587**.

Affinities.

This species differs from *D. irregularis* (d'Orb.) owing to the greater length and regularity of its radii.

D. 4587. A zoarium attached to a crushed *Nautilus*. Lower Chalk. Southeram Pit, east of Lewes. Capron Coll. Figd. Pl. I. Figs. 10*a*, *b*.

UNREPRESENTED SPECIES.

1. **cenomana** (Michelin), 1846.

Syn. *Lichenopora cenomana*, Michelin, 1846. Icon. Zooph. p. 204, pl. lii. fig. 14.
,, (*Discocavea*) *cenomana*, Pergens, 1890. Rev. p. 382.
Defrancia cenomana, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 175.
,, ,, d'Orbigny, 1851. Bry. Crét. pl. 642, figs. 9–11.
Discocavea ,, d'Orbigny, 1853. *Ibid.* p. 960.
Defrancia radiata, d'Orbigny, 1851. *Ibid.* pl. 642, figs. 4–6.
Unicavea subradiata, d'Orbigny, 1853. *Ibid.* p. 972.

Char.—Zoarium adnate, with a convex upper surface; irregularly elliptical or lobed in outline. The typical *cenomana* has a small central area, a lobed margin, and radial solid ridges; the form *subradiata* has a larger central area and regular lines of apertures, which are thickest at their inner ends.

Distrib.—Cenomanian: Le Mans, Sarthe; Île Madame, Charente-Inférieure.

Aff.—M. Pergens is the authority for the union of these two apparently distinct forms in the same species.

2. **compressa** (d'Orbigny), 1851.

Syn. *Lichenopora compressa*, d'Orbigny, 1851. Bry. Crét. pl. 645, figs. 5-8.
non ,, ,, Vine, 1889. Further on Cambr. Greensd.: Proc. Yorks. Geol. Soc. new ser. vol. xi. p. 270, pl. xii. figs. 11, 12.
Discocavea ,, d'Orbigny, 1853. Bry. Crét. p. 961.
Domopora ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 43.
Lichenopora pocillum, *pars*, Pergens, 1890. Rev. p. 382.

Char.—Zoarium turbinate, laterally compressed. Upper surface only slightly convex, with a long elliptical central area of crowded zoœcia. Linear series of apertures short and regular, about thirty-two in number, alternately long and short; the longer series have about seven or eight apertures.

Distrib.—Senonian—Maastrichtian: Meudon, near Paris; ? Maastricht (*fide* Hamm).
Coniacian: Les Roches, Loir-et-Cher.

Aff.—This is the Senonian representative of *D. pocillum*, from which it differs by its shorter and straighter lines of apertures and its compressed zoarium. Vine's *L. compressa* is redescribed on p. 32 as a *Discofascigera vinei*.

3. **discus** (Počta), 1892.

Syn. *Lichenopora discus*, Počta, 1892. Mech. Koryc. Hory: Ceska Ak. Fr. Jos. Praze, sect. ii. pp. 27–8, 33, 41, pl. iv. fig. 12.

Char.—Zoarium irregularly elliptical, tumid, with about six of the central zoœcia raised highly above the general surface. Apertures large; in irregular, uniserial rows, with only occasional mesopores.

Dimensions.	mm.
Diameter of zoarium	4–7
Length of zoœcia	·5
Diameter of apertures	·19

Distrib.—Cenomanian—Korycaner Schichten: Kank, Bohemia.

4. **elegans** (Simonowitsch), 1871.

Syn. *Radiopora elegans*, Simonowitsch, 1871. Bry. Essen.: Verh. nat. Ver. preuss. Rheinl. vol. xxviii. p. 38, pl. ii. figs. 1*a–e*.
non Actinopora (*Radiopora*) *elegans*, Etheridge & Newton, 1878. Cat. Cret. Foss. Mus. Pract. Geol. p. 6.

Char.—Zoarium fungiform, with a flat base, expanding stem, and convex upper surface. About 4 mm. in diameter and 3 mm. high. Apertures in about sixteen uniserial rows, confined to the upper surface. The radial series are alternately long and short; the long rows reach to the edge of the central porous depression, and have eight to nine apertures in each; the shorter rays each contain four to five apertures. The radial series are well separated, with from two to three lines of mesopores between them. Side of the zoarium marked by crowded mesopores.

Distrib.—Cenomanian: Essen.

Aff.—The specimens from the Lower Greensand of Farringdon, identified as *Radiopora elegans* by Etheridge & Newton, are *Idmonea hagenowi* (Sharpe).

5. **multiradiata** (von Reuss), 1872–3.

Syn. *Defrancia multiradiata*, *pars*, von Reuss, 1872–3. Bry. unt. Quad.: Palæontogr. vol. xx. pt. i. p. 111, pl. xxvii. fig. 5 (*non* 6).

Char.—Zoarium fungiform; broad peripheral zone traversed by very numerous radial rows, with from ten to twelve apertures in each row. The rows are uniserial for most of the length, but appear to be biserial at the outer end. Well-marked central depressions. The innermost aperture of the principal radial rows is very large.

Distrib.—Cenomanian—Lower Quader: Saxony.

6. **neocomiensis**, d'Orbigny, 1853.

Syn. *Discocavea neocomiensis*, d'Orbigny, 1853. Bry. Crét. p. 959, pl. 785, figs. 6–9.
non ,, ,, Etheridge & Newton, 1878. Cat. Cret. Foss. Mus. Pract. Geol. p. 7.

Char.—Zoarium a large, thin, irregular disc, 8 mm. long by 6 mm. wide. Large central depression. The large apertures occur in radial lines, about thirty-four in number; the longest lines contain six apertures.

Distrib.—Neocomian: Morteau, Doubs.

Aff.—The type-specimen, according to M. Pergens (Rev. p. 384), is lost. The specimen from the Lower Greensand of Farringdon, Berkshire, in the Cunnington Collection in the Museum of Practical Geology, is a near ally of this species; but it is a broken specimen, with diameters 10 and 6·5 mm. It differs from d'Orbigny's figured specimen by having a smaller central depression, by having two radial centres, and has twelve instead of six apertures in each radial row.

7. **pocillum** (d'Orbigny), 1851.

Syn. *Lichenopora pocillum*, d'Orbigny, 1851. Bry. Crét. pl. 645, figs. 1–4.
,, (*Discocavea*) *pocillum*, *pars*, Pergens, 1890. Rev. p. 382.
?*non* ,, ,, ,, Canu, 1900. Bry. Tours: C.R. Assoc. franç. Av. Sci. 1899, p. 410.
,, *pocillum*, Ulrich, 1900. In Zittel-Eastman, Textbook Palæont. vol. i. p. 265, fig. 430.
Discocavea ,, d'Orbigny, 1853. Bry. Crét. p. 959.

Char.—Zoarium turbinate, attached by a short stalk, expanding rapidly upward, and with a convex upper surface. Lower surface covered by thick epizoarium. Central depression with about twenty apertures. Radial series long, irregular, and sinuous, with twelve to fourteen apertures in the longer rows.

Distrib.—Cenomanian: Le Mans. In the work quoted in the synonymy M. Canu records this species from the Coniacian of Tours.

8. **vassiacensis** (d'Orbigny), 1850.

Syn. *Defrancia vassiacensis*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 120.
,, ,, d'Orbigny, 1851. Bry. Crét. pl. 642, figs. 1–3.
Unicavea ,, d'Orbigny, 1853. *Ibid.* p. 972.
,, ,, Pergens, 1890. Rev. p. 384.

Char.—Zoarium adnate, flat, but with a convex, well-raised upper surface. A large central area of crowded, irregular apertures. The series of apertures are irregular in length; the longest include about eight apertures; the lines are separated by wide porous areas.

Distrib.—Aptian: Grange-au-Ru, near Vassy, Haute-Marne; les Croûtes, Aube.

SEMIMULTICAVEA, d'Orbigny, 1853.

[Bry. Crét. p. 979.]

SYNONYMS.

Ceriopora, *pars*, Michelin, 1841.
non Radiopora, d'Orbigny, 1851.
Semimulticavea, Hamm, 1881; *non* Simonowitsch, 1871.
Lichenopora, *pars*, Pergens, 1890.
Heteroporella, Hennig, 1894.

DIAGNOSIS.

Radioporidæ with a compound zoarium composed of a thick lamellar sheet made of confluent colonies, each having the structure of *Discocavea*.

TYPE SPECIES.

Ceriopora landrioti, Michelin, 1841. Albian: Belgium. Aptian: Switzerland.

Semimulticavea variolata, n.sp.

DIAGNOSIS.

Zoarium an incrusting sheet, thinner than usual in the genus. Surface marked by circular shallow depressions, giving the zoarium a variolate aspect. The central groups of mesopores are irregularly defined.

The zoœcial groups are circular, and their boundaries are not sharply defined.

Apertures in irregular radial series. Each line of apertures separated by a line of mesopores.

DIMENSIONS.

	mm.
Area of zoarium	12 × 15
Average diameter of depressions	1·5
Diameter of apertures...	·12–·15
Diameter of mesopores	·05

FIGURES.

Pl. V. Fig. 5. The type-specimen, with *Ceriopora collis* (d'Orb.), incrusting a *Terebratula*. Lower Greensand: Farringdon. **D. 3027.**

Fig. 5*a*. The zoarium; nat. size.

Fig. 5*c*. Part of the surface; × 12 dia.

DISTRIBUTION.

Lower Greensand: Farringdon.

Affinities.

This species is most nearly related to *S. landrioti* (Mich.), from which it differs by having a pitted instead of a tubercular zoarium, and circular instead of polygonal zoœcial groups, which are not sharply separated. The zoarium in the type-specimen is also thinner.

D. 3027. The type-specimen incrusting a *Terebratula*, with *Ceriopora collis* (d'Orb.). Lower Greensand. Farringdon. Figd. Pl. V. Figs. 5*a*, *c*. Old Coll.

UNREPRESENTED SPECIES.

1. landrioti (Michelin), 1841.

Syn. *Ceriopora landrioti*, Michelin, 1841. Icon. Zooph. p. 2, pl. i. fig. 10.
Radiopora ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 140.
,, ,, d'Orbigny, 1851. Bry. Crét. pl. 648, figs. 5–7.
Semimulticavea landrioti, d'Orbigny, 1853. *Ibid.* p. 980.
Lichenopora ,, Pergens, 1890. Rev. p. 382.

Char.—Zoarium a large, irregular, incrusting sheet. The surface is tubercular. Sub-colonies polygonal, with a central depression, and long, straight, crowded, radial lines of apertures, with usually from four to six apertures in each line.

Distrib.—Albian: Grandpré and St. Loup, Ardennes.
Aptian: Sainte-Croix, Vaud.

2. macropora, Hamm, 1881.

Syn. *Semimulticavea macropora*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 41.

Char.—"Zoarium uni- or multilamellar, proportionately massive. Zoœcia and zoœcial groups large. The middle area much depressed. Apertures on the middle area and between the radial series are much contracted by a concave transverse wall. Radial series short, on low ridges consisting of five or six together, with slightly compressed apertures." (Hamm.)

Distrib.—Senonian—Maastrichtian: Maastricht.

3. meudonensis, d'Orbigny, 1853.

Syn. *Semimulticavea meudonensis*, d'Orbigny, 1853. Bry. Crét. p. 982, pl. 779, figs. 5–8.
Lichenopora ,, Pergens, 1890. Rev. p. 383.
,, ,, Canu, 1902. Bry. foss. ii., Coll. Dutemple: Bull. Soc. géol. France, ser. 4, vol. ii. p. 14.

Char.—Zoarium an irregular sheet. Upper surface convex. Each sub-colony has a large central circular depression, from which radiate about eleven lines of apertures, containing about three or four apertures in each line.

Distrib.—Senonian—Maastrichtian: Meudon, near Paris; Chavot.

4. **multistella**, d'Orbigny, 1851.

Syn. *Radiopora multistella*, d'Orbigny, 1851. Bry. Crét. pl. 649, figs. 5-7.
Semimulticavea ,, d'Orbigny, 1853. *Ibid.* p. 981.
Lichenopora (*Semimulticavea*) *multistella*, Pergens, 1890. Rev. p. 383.

Char.—Zoarium a flat incrustation or expansion formed of many zoœcial groups. The radial rows of apertures in each group are few in number (about eight); they are thick and highly raised, but each contains only a short row of three or four apertures.

Distrib.—Cenomanian: Le Mans, France.

5. **pustulosa**, d'Orbigny, 1850.

Syn. *Radiopora pustulosa*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 176.
,, ,, d'Orbigny, 1851, 1854. Bry. Crét. p. 994, pl. 649, figs. 1-4.
,, ,, Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 508.
non ,, ,, Vine, 1884. Cret. Lich.: Quart. Journ. Geol. Soc. vol. xl. p. 850, fig. 1, p. 851, and p. 852.
non ,, ,, Vine, 1884. Fourth Report: Rep. Brit. Assoc. 1883, p. 170.
Lichenopora (*Radiopora*) *pustulosa*, Pergens, 1890. Rev. p. 383.

Char.—Zoarium a broad comparatively thin expansion of numerous zoœcial groups. Each group has a large central depression in which the apertures are irregularly arranged; from this area diverge radial rows of apertures; there are about twenty-two to twenty-four radial rows, with from four to seven apertures in each.

Distrib.—Cenomanian: Havre and Île Madame, France.

6. **reticulata**, Hamm, 1881.

Syn. *Semimulticavea reticulata*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 41.

Char.—Zoarium creeping. The single zoœcial groups agree with those of *Domopora reticulata*, Hag. These stellate groups are not independent, but are developed in connection with one another.

Distrib.—Senonian—Maastrichtian: Geulhem, Belgium.

7. **variabilis** (Hennig), 1894.

Syn. *Heteroporella variabilis*, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 25, pl. ii. fig. 28.

Char.—A small irregular zoarium which in the type-specimen is 5 mm. long by a little less than 2 mm. wide. It consists of three sub-colonies in a row. There are three or four apertures in each radial series. Apertures ·06 in diameter.

Distrib.—Senonian—Campanian—Zone of *Belemnitella mucronata*—Åhus Sandstone: Åhus, Sweden.

MULTICAVEA, d'Orbigny, 1853.

[Bry. Crét. p. 975.]

SYNONYM.

Multicavea, Hamm, 1881; Pergens, 1890; Ulrich, 1900.

DIAGNOSIS.

Radioporidæ in which the zoarium is dendroid. The zoœcia are arranged with their apertures opening in uniserial lines, arranged radially around circular cancellate areas on the stems. The central axis consists of a bundle of long parallel zoœcia.

TYPE SPECIES.

Multicavea magnifica, d'Orbigny, 1853. Senonian: France.

AFFINITIES.

This genus may be described as consisting of colonies of *Discocavea* growing into a dendroid zoarium.

UNREPRESENTED SPECIES.

1. **magnifica**, d'Orbigny, 1854.

SYN. *Multicavea magnifica*, d'Orbigny, 1854. Bry. Crét. p. 977, pl. 778, fig. 10, pl. 779.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 40, figs. 1–4.
,, ,, Pergens, 1890. Rev. p. 384.

CHAR.—Zoarium of cylindrical branches from 3 to 6 mm. in diameter. Zoarium growing in large tufts, 80 mm. high. The radial lines of zoœcia are short, usually containing three apertures, and the lines are widely separated, and there are about ten or twelve radial lines in each group.

DISTRIB.—Senonian—Maastrichtian: Royan, Charente-Inférieure.

2. **annulata**, Hamm, 1881.

SYN. *Multicavea annulata*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 40.

CHAR.—"Zoarium irregularly and dichotomously branched; the branches are thick and cylindrical, and the upper surface is traversed by wave-like cross folds. The top of the cross folds forms the middle point of the groups of zoœcia; these groups are also much elongated transversely. The apertures are very small, and thickly crowded; the larger are quite surrounded with a weak, ring-shaped edge, and stand in very irregular, often quite indistinct series, which are arranged at right angles to the transverse ridges." (Hamm.)

DISTRIB.—Senonian—Maastrichtian: Petersberg, Maastricht.

3. ? lateralis, d'Orbigny, 1853.

Syn. *Multicavea lateralis*, d'Orbigny, 1853. Bry. Crét. p. 976, pl. 778, figs. 7–9.
,, ,, Pergens, 1890. Rev. p. 384.

Char.—The zoarium is dendroid, of cylindrical dichotomous branches. The apertures are represented as in irregular groups. The structure, according to d'Orbigny's section (fig. 9), appears cancellate; but according to Pergens the specimen does not correspond with d'Orbigny's figures.

4. pustulosa, Hamm, 1881.

Syn. *Multicavea pustulosa*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 40.

Char.—Zoarium slightly and irregularly branched. Branches short, cylindrical, conical, or club-shaped, with knob-like elevations on the upper surface. Apertures very small, and thickly crowded; the larger zooecia occur in rows of four or five, which are arranged regularly and radially from the middle of the knobs.

Distrib.—Senonian—Maastrichtian: Maastricht.

PYRICAVEA, d'Orbigny, 1853.

[Bry. Crét. p. 974.]

Diagnosis.

Radioporidæ with the zoarium dendroid; of piriform sub-colonies, growing in vertical branched series, connected by short cylindrical stems. The apertures open in uniserial vertical series on slightly raised ridges, separated by grooves with single series of cancelli.

Type Species.

Pyricavea francqana, d'Orbigny. Senonian: France.

UNREPRESENTED SPECIES.

francqana, d'Orbigny, 1853.

Syn. *Pyricavea francqana*, d'Orbigny, 1853. Bry. Crét. p. 975, pl. 778, figs. 3–6.
Lichenopora (*Pyricavea*) *francqana*, Pergens, 1890. Rev. p. 382.
Defrancia francqana, Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 509.

Char.—From ten to fifteen apertures in each vertical series. Piriform sub-colonies, 2–4 mm. in diameter.

Distrib.—Senonian—Maastrichtian: Meudon, near Paris; also Seine-Inférieure (*fide* Bucaille).

LICHENOPORA, Defrance, 1823.

[Dict. Sci. nat. vol. xxvi. p. 256.]

SYNONYMS.

Ceriopora, *pars*, Goldfuss, 1827; von Hagenow, 1846.
Domopora, *pars*, d'Orbigny, 1850; Hamm, 1881; Vine, 1885.
Defrancia, *pars*, von Hagenow, 1851; Schlüter, 1870; Marsson, 1887; Osswald, 1890; Bucaille, 1890.
Lichenopora, *pars*, von Reuss, 1846; d'Orbigny, 1852, 1853; Ubaghs, 1879; Pergens, 1888, 1890; Hennig, 1894; *pars*, Ulrich, 1900.
Tubulipora, *pars*, Michelin, 1844.
Recticavea, d'Orbigny, 1853.
Tecticavea, d'Orbigny, 1854; *non* Macgillivray, 1895.
Radiocavea, d'Orbigny, 1853; Winkler, 1864; Ubaghs, 1879; *pars*, Hamm, 1881.
? *Lopholepis*, *pars*, Marsson, 1887.
Heteroporella, von Reuss, 1872, 1873.

DIAGNOSIS.

Radioporidæ with the zoarium circular, and either adnate by the whole of the flat, broad base, or sub-conical and attached by a narrow base. There is a central depression on the upper surface; and from the central depression radiates a series of grooves separating raised elliptical or sub-elliptical zoœcial bundles.

The zoœcia having their apertures in the radial bundles are larger than those opening in the intervening grooves, which may be all mesopores.

TYPE SPECIES.

Lichenopora turbinata, Defrance, 1823: Dict. Sci. nat. vol. xxvi. p. 257. Middle Eocene (Calcaire grossier): Hauteville and Orglandes, Manche.

AFFINITIES.

This genus is used differently by many zoologists and palæontologists, and it seems to me clear that in this case the palæontologists are correct. The genus was founded by Defrance in 1823, and, according to his diagnosis, the zoœcia open on the upper surface on either "des crêtes ou des rangées de tubes rayonnantes." The diagnosis, therefore, does not distinguish between the forms with the apertures in uniserial rows and those in elliptical bundles. The genus, however, included only three species, *L. turbinata* and *L. crispa*, both from the Falunian of the Manche, and *L. cretacea* from the Maastrichtian of Meudon and Maastricht.

The first-named species is *L. turbinata*; it is the only species figured by Defrance (Atlas, pl. of fossils, fig. 4), and d'Orbigny (Bry. Crét. p. 963) expressly selected that species as the type of the genus.

That species was well figured, e.g. by Michelin ; has a turbinate zoarium, and has the apertures in elliptical radial bundles, and not in single radial lines. Hence the common recent species *verrucaria* (Fabr.) or *novæzelaniæ* (d'Orb.) are wrongly referred to *Lichenopora*. They belong to *Discocavea* of d'Orbigny. Zoologists may think that the genus *Lichenopora* is so well known that to alter the name of the recent species is inconvenient; but many zoologists, such as Busk,[1] have rejected *Lichenopora* as applicable to the recent species. The number of fossil species is larger than of recent species, and there seems no adequate reason for departing from the rules of nomenclature in this case.

Radiocavea, d'Orbigny, should be merged in *Lichenopora*. It was founded by d'Orbigny, and, according to him, the one difference is that *Radiocavea* is "entièrement fixé, rampante dans toutes ses parties." This distinction does not seem to me adequate, especially as d'Orbigny placed the form *sellula*, Hag., in *Radiocavea*, although it is sub-pedunculate.

D'Orbigny expressly remarked[2] that he restricted the name *Lichenopora* to "Bryozoaires coniques, fixés par la pointe du cône," and assigned to the genus two Eocene species.

The generic name *Defrancia* has been widely applied to these fossils. That name was founded by Bronn in 1825[3]; but his type, indeed the only species he mentions, was *Defrancia clypeata* of Lamouroux, which is the same species as *Apsendesia cristata*, which in 1821 had been made the type of Lamouroux's genus *Apsendesia*.[4] *Defrancia* has, therefore, necessarily to be abandoned, as a synonym of *Apsendesia*.

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[1] Busk. B.M. Cat. Mar. Polyzoa, vol. iii. pp. 30, 32.

[2] D'Orbigny. "Cours Élémentaire de Paléontologie," 1852, vol. ii. p. 110.

[3] H. G. Bronn. System der urweltl. Pflanzenth., 1825, pp. 13, 42, pl. iv. figs. 7*a–c*.

[4] Lamouroux. Expos. Méth. Polyp. 1821, p. 82.

Various stages in the development of the Cretaceous *Lichenopora* are illustrated in Figs. 67–72, pp. 252 et seq. The youngest stages, such as that represented by Fig. 67 (**D. 3454a**), of a young zoarium 4 mm. in diameter, show only the most rudimentary traces of the radii, though the interfascicular grooves are faintly indicated. The radii are still irregularly developed, but more advanced in the specimen, 4·5 mm. in diameter, shown in Fig. 68 (**D. 3454b**), in which the floors of the more regular interfascicular grooves are lined by two rows of apertures, and the fasciculi are multiserial; there is a well-developed central depression, on the floor of which open about eighteen zoœcia with apertures still open and a little larger than those forming the rest of the zoarium.

The growth of a zoarium which shows budding into a subcompound colony is illustrated by specimens **D. 3445** and **D. 3446**, Figs. 69–72.

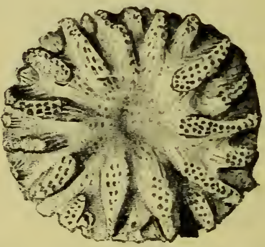


Fig. 62.—*Lichenopora stellata*, var. *fusiformis*. Upper surface ; × 5. **D. 3510.**

Lichenopora stellata (Goldfuss), 1827.

Synonymy.

Ceriopora stellata, Goldfuss, 1827. Petref. Germ. vol. i. p. 39, pl. xi. figs. 11*a*, *b*.
non ,, ,, Goldfuss, 1829. *Op. cit.* p. 85, pl. xxx. fig. 12.
,, ,, ,, Koch & Dunker, 1837. Beitr. nordd. Ool. p. 55, pl. vi. fig. 12 (= *Actinopora*).
,, ,, *pars*, Morren, 1829. Corall. foss. Belg.: Ann. Acc. Groning. 1828, p. 42.
non Domopora stellata, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 267.
,, ,, Vine, 1885. Fifth Report: Rep. Brit. Assoc. 1884, p. 151.
Lichenopora ,, d'Orbigny, 1853. Bry. Crét. p. 963.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 225.
Ceriopora diadema, Goldfuss, 1827. Petref. Germ. vol. i. p. 39, pl. xi. figs. 12*a–c*, *non e*, *f*.
,, ,, *pars*, Römer, 1840. Verst. nordd. Kr. p. 20.
Domopora ,, ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 267.

Defrancia diadema, pars, von Hagenow, 1851. Bry. maastr. Kr. p. 43, pl. iv. fig. 4 (*non* fig. 3 as stated by error in text and description of plate).
Radiocavea defrancia, Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 211.
,, *diadema*, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 224.
,, ,, *pars*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 43.
Lichenopora ,, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 33.
Ceriopora costata, von Hagenow, 1846. In Geinitz, Grundr. Verst. vol. ii. p. 594, pl. xxiii B, fig. 8.
Defrancia cariosa, von Hagenow, 1851. Bry. maastr. Kr. p. 44, pl. iv. fig. 6.
Domopora (*Defrancia*) *cariosa*, Vine, 1885. Fifth Report: Rep. Brit. Assoc. 1884, p. 151.
Lichenopora cariosa, d'Orbigny, 1853. Bry. Crét. p. 963.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 225.
,, ,, Pergens, 1888. Tuf. Ciply: Bull. Soc. belge Géol. vol. i. p. 205.
,, ,, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 34.
Radiocavea ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 43.
Defrancia sellula, von Hagenow, 1851. Bry. maastr. Kr. p. 44, pl. iv. fig. 7.
Domopora (*Defrancia*) *sellula*, Vine, 1885. Fifth Report: Rep. Brit. Assoc. 1884, p. 151.
Radiocavea sellula, d'Orbigny, 1853. Bry. Crét. p. 965.
,, ,, Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 211.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 224.
,, *reticulata* (*non* Hag.), d'Orbigny, 1853. Bry. Crét. p. 965.
,, ,, Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 211.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 225.
Lichenopora ,, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 33.
Domopora ,, (*non* Hag.), Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 43.
,, (*Defrancia*) *reticulata*, Vine, 1885. Fifth Report: Rep. Brit. Assoc. 1884, p. 151.
non Tecticavea boletiformis, d'Orbigny, 1854. Bry. Crét. p. 991, pl. 781, figs. 8–12.
Defrancia obvallata, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv. p. 38, pl. iii. fig. 12.

DIAGNOSIS.

Zoarium discoid, circular, or oval; attached by a broad flat base with a short broad stalk, or sessile. In the middle of the upper surface is a large central depression, whence radiate from about twelve to twenty rays, formed of raised groups of peristomes. These rays are fusiform, lanceolate, or clavate. Secondary rays occur between the larger rays. Each ray is bounded by a calcareous lamina. The rays are separated by radial grooves, which may be covered by an imperforate floor, or may be pierced by the apertures of the smaller, shorter zoœcia.

Var. *sellula*: small zoaria, with a large central area.

Var. *fusiformis*, var. nov.: zoaria with large, regular, fusiform rays.

DIMENSIONS.

	D. 3510. mm.	60,156. mm.
Diameter of zoarium	6 × 6·5	9
Thickness of zoarium	—	4
Length of radial zoœcial bundles	2	3
Maximum width of zoœcial bundles ...	·8	·75
Diameter of aperture	·15	·15

DISTRIBUTION.

Danian: Annetorp, Sweden.

Senonian—Maastrichtian: Maastricht; Ciply.

Campanian: Rügen. Zone of *Belemnitella mucronata* (beds with *Actinocamax mamillatus*): Ignaberga, Balsberg, Karlshamm, and Ö. Karup.

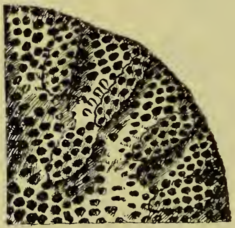


FIG. 63.—*Lichenopora stellata*; × 6⅔. **60,156a.**

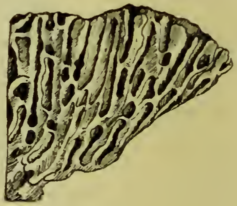


FIG. 64.—*Lichenopora stellata.* Part of a vertical section; × 6⅔. **60,156a.**

FIGURES.

Fig. 62, p. 248. A zoarium from above of var. *fusiformis*; × 5 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3510.**

Fig. 63. A quadrant of the upper surface of a zoarium, showing the radial zoœcial bundles and central depressed area; × 6⅔ dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **60,156a.**

Fig. 64. Side view of vertical section through the same zoarium; × 6⅔ dia. **60,156a.**

Fig. 65, p. 251. Part of a thin vertical section through a zoarium, showing the zoœcia partly in longitudinal and partly in transverse sections; × 13⅓ dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **60,156b.**

Fig. 66. Part of a thin transverse section across the lower part of the same zoarium; × 20 dia. **60,156b.**

Fig. 67, p. 252. The upper surface of a young zoarium, 4 mm. in diameter, in the *subcariosa* stage; the radial structure is only faintly indicated; × 6 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3454a.**

Fig. 68, p. 252. The upper surface of an older zoarium than Fig. 67, but still in the *cariosa* stage, attached to the same specimen as that shown in Fig. 67; × 6 dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3454b.**

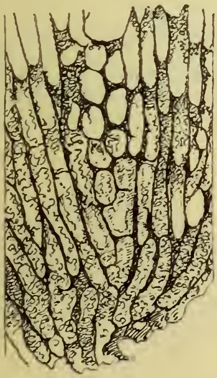


FIG. 65.—*Lichenopora stellata.* Thin vertical section; × 13⅓. **60,156b.**

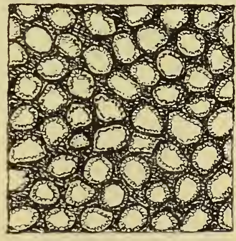


FIG. 66.—*Lichenopora stellata.* Thin horizontal section; × 20. **60,156b.**

Fig. 69, p. 253. Side view of a zoarium in the *subcariosa* stage; × 6 dia. It consists of four confluent colonies. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3445.**

Fig. 70, p. 253. View of the upper surface of the same specimen; × 6 dia. **D. 3445.**

Fig. 71, p. 254. Side view of another compound zoarium, of which the constituent colonies are in the *cariosa* and *subcariosa* stages; × 5⅓ dia. Maastrichter Kalk: Maastricht. Van Breda Coll. **D. 3446.**

Fig. 72, p. 254. Upper surface of the same specimen; × 5⅓ dia. The colony on the right-hand side of the specimen is in the *subcariosa* stage; the colony on the left is in the *cariosa* stage. **D. 3446.**

AFFINITIES.

This common species has been unfortunate in nomenclature, and there is much to be said for the simple but drastic step of abandoning all the names before that of *obvallata* proposed by Marsson in 1887. The species had previously received the names of *stellata*, *costata*, *reticulata*, and *diadema*.

The oldest name is that of *Ceriopora stellata*, Goldfuss, originally based on a pedunculate variety of this species from Maastricht (Goldfuss, *op. cit.* 1827, pl. xi. figs. 11*a*, *b*), but subsequently (1829, pl. xxx. fig. 12) including a typical specimen of the Essen Bryozoan, usually known as *Domopora stellata* (= *Tholopora virgulosa*, p. 277). Goldfuss figured a second specimen of the Maastricht species (pl. xi. figs. 12*a–c*), but included it in his species *Ceriopora* (now *Actinopora*) *diadema*; the other specimen figured as that species (pl. xi. figs. 12*e*, *f*) is taken as its type. It is clear, then, that the original of Goldfuss' pl. xi. figs. 11*a*, *b*, is free to serve as the type-specimen of his *Ceriopora stellata*.

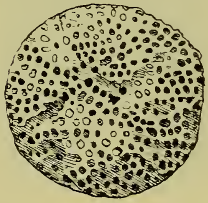


FIG. 67.—*Lichenopora stellata*. Upper surface of a zoarium in the *subcariosa* stage; × 6. **D. 3454a.**

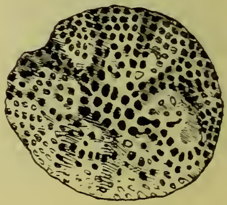


FIG. 68.—*Lichenopora stellata*. Upper surface of zoarium in the *cariosa* stage; × 6. **D. 3454b.**

Von Hagenow's name *Defrancia reticulata* of 1851 has been applied to this *Lichenopora* only owing to the unfortunate misprint, whereby the references to *reticulata* and to one figure of *diadema* given on von Hagenow's plate are reversed in the explanation of the plates and in the reference in the text. This accident was pointed out by Marsson; it appears at first sight improbable, as von Hagenow must have overlooked the fact that he gave four figures numbered as fig. 3, and only three of his fig. 4; but the description of the species renders it clear that it is the Bryozoan shown on the plate as fig. 3, which is his *reticulata*.

The statements in the diagnosis of the species *reticulata* (p. 43) that in each radial series of apertures "there is only a single row of round apertures" and that the outer edge of the disc is "mostly somewhat cocked [*gekrämpt*] upwards," apply to fig. 3 and not fig. 4. It is therefore clear that the name *reticulata* must be applied to the Bryozoan well described by von Hagenow (p. 43) and shown in his pl. iv. fig. 3, and that the species is a *Discocavea*. It is not a *Lichenopora*, although it was included by d'Orbigny (Bry. Crét. p. 965) in *Radiocavea*, as he, overlooking the misprint, accepted von Hagenow's pl. iv. fig. 4, as the type of *reticulata*.

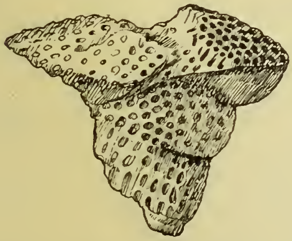


Fig. 69.—*Lichenopora stellata*. Side view of a compound zoarium in the *subcariosa* stage; × 6. **D. 3445.**

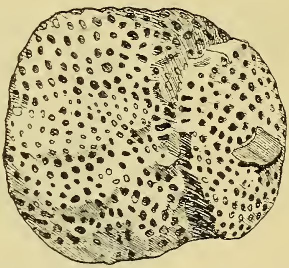


Fig. 70.—*Lichenopora stellata*. Upper surface of same specimen as Fig. 69; × 6. **D. 3445.**

There are four other names later than those of Goldfuss available for this species; they are—

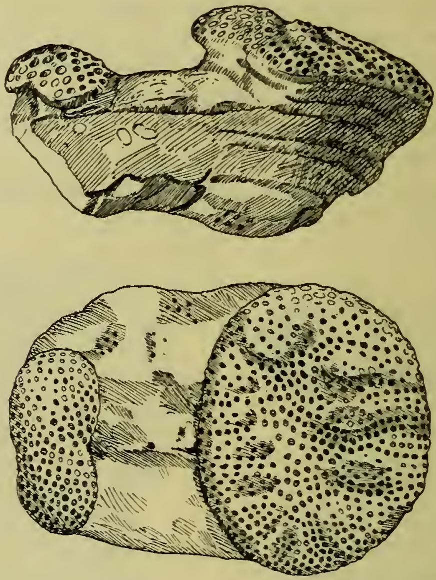
costata, von Hagenow, 1846, which is represented by a poor but still recognizable figure.

sellula, von Hagenow, 1851, founded as a distinct species, but merged with the main form by Hamm; the name may be retained for a variety connected with the typical form and with the intermediate variety, which I have called *subsellula*.

cariosa, von Hagenow, 1851. This name is here retained for an early growth-stage of this species. The name *subcariosa* is used for specimens in a still younger stage.

obvallata, Marsson, 1887, founded owing to the confusion in the older names.

There seems to me no adequate reason for the supersession of the older names; *costata* might have been overlooked, as it is not well described or figured, but the figures of *sellula* were excellent. Further discussion, however, is unnecessary, for the obvious course is to adopt *stellata* as the oldest available name.



Figs. 71 and 72.—*Lichenopora stellata.* A compound zoarium in the *cariosa* and *subcariosa* stages; × 5⅓. **D. 3446.** Fig. 71, side view; Fig. 72, upper surface.

LIST OF SPECIMENS.

D. 3510. A zoarium of var. *fusiformis*. Maastrichter Kalk. Maastricht. Van Breda Coll. Fig. 62, p. 248.

? 60,156. Box with about sixty zoaria of pedunculate form. Maastrichter Kalk. Maastricht. Van Breda Coll. Two zoaria are selected for figures and sections.

60,156a, b. Figs. 63, 64, p. 250; Figs. 65, 66, p. 251.

D. 3445. A zoarium of four sub-confluent colonies in the *subcariosa* stage. Maastrichter Kalk. Maastricht. Van Breda Coll. Figs. 69, 70, p. 253.

D. 3446. A compound zoarium 10 mm. long, 7 mm. wide, and 5 mm. high. It consists of a parent colony and two younger ones growing from the upper surface of the parent; the larger of the two secondary zoaria has radial groups of apertures, but they are not developed in the smaller zoarium, which is therefore in the *cariosa* stage. This specimen shows that *L. costata* passes through a *cariosa* stage. Maastrichter Kalk. Maastricht. Van Breda Coll. Figs. 71, 72, p. 254.

D. 3454. Three zoaria, of which one is one of the variety with the zoarium pointed below; the second is an unsymmetrical zoarium, with raised groups of apertures on one half but not on the other; the third is a young zoarium in the *cariosa* stage. These three zoaria show the relation of the *stellata* to the *cariosa* stage; one is a simple *cariosa*; the second has small prominences marking the beginning of the radial groups of the adult *stellata*; the third is a broken specimen with the better developed stellate characters of *stellata*. Maastrichter Kalk. Maastricht. Van Breda Coll. Figs. 67, 68, p. 252.

60,159. A collection of sixty-eight zoaria; they are flat-based forms, usually with short fusiform bundles of zoœcia and large central areas; they are therefore the var. *sellula* of von Hagenow. They vary in diameter from 3 to 7 mm. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 1395. A zoarium (8 mm. in diameter) with a young zoarium in the stage *cariosa* (2 mm. in diameter) growing on it. Labelled *Defrancia diadema* by Vine. Maastrichter Kalk. Maastricht. Vine Coll.

D. 1396. Two zoaria (on slide); one is 5 mm. in diameter; the other, which is in the *subsellula* stage, is 3·5 mm. in diameter. Labelled *Defrancia diadema* by Vine. Maastrichter Kalk. Maastricht. Vine Coll.

D. 1397. A young zoarium, 2·5 mm. in diameter. Labelled by Vine *Defrancia sellula*. Maastrichter Kalk. Maastricht. Vine Coll.

D. 3425. A tube with seventeen zoaria, which vary greatly in shape, but most of them are of the conical pedunculate form; they vary from forms twice as wide as they are high to others in which the diameter and height are equal. Some have blunt flat forms, 10 mm. in diameter and barely 5 mm. thick; most of these flat varieties have a base with a small projecting peduncle; one of them, which is 10 mm. in diameter by 4 mm. high, has no trace of the peduncle. Of the fungiform specimens one has a disc 7 mm. in diameter and 2 mm. thick, on a flat-based peduncle 4 mm. long and 3 to 4 mm. thick; another is regularly obconic, though with flat point, and it is 6 mm. in diameter and 6 mm. high, and has a base 2·5 mm. in diameter; another has a narrow curved peduncle. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3426. One zoarium in the *cariosa* stage, 5 mm. in diameter and 4·5 mm. high, with the surface very worn. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3430. A very worn thick zoarium. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3431. A zoarium, attached to which is a young specimen in the *cariosa* stage. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3432. A zoarium in the *cariosa* stage (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3433. Two small zoaria (in tube). Both specimens are turbinate. The larger is 6 mm. in diameter by 4 mm. thick, but has indication of radial groups. The smaller is 5 mm. in diameter and 3 mm. thick. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3434. Five small zoaria (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3435. Two zoaria, elliptical in horizontal section; one is 4·5 mm. long by 2·5 mm. across, and 6 mm. high (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3436. A regular zoarium (on slide), 10 mm. diameter and 4 mm. high, having a large deep central depression with vertical walls 1 mm. high, and a flat floor 2 mm. in diameter. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3437. Two zoaria; both are undergoing fission; the one most advanced in fission is 9 mm. long by 6 mm. at maximum width, and constricted to 5 mm. across; it is 3 mm. high. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3438. A specimen of the normal form, attached to which is a young specimen in the *cariosa* stage (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3439. A small regular zoarium of the turbinate variety, 5·5 mm. in diameter and 4 mm. high. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3440. Three zoaria (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3441. Three zoaria (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3442. A zoarium after the *cariosa* stage, with the traces of the radial bundles well shown. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3443. Tube and eighteen zoaria of pedunculate form. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3444. Fifteen zoaria. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3447. A large zoarium, 10 mm. high, 10 mm. diameter, with a worn flat upper surface and a pointed base. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3450. Eighty-nine zoaria of the variety with a pointed base. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3460. A zoarium with tooth-shaped elevations instead of ridges (on slide). Blunt peduncle. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3472. Two zoaria (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3501. A zoarium more worn than in **D. 3442**, having a flat upper surface on which there is only a faint trace of radial structure. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3504. An oval zoarium (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3506. Two zoaria (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3507. Three zoaria of var. *fusiformis*, with the bundles rising into spikes (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3508. Three worn flat-based zoaria, with fusiform bundles and deep central cavity (on slide). Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3513. A tube with twenty zoaria, flat-based and high-ridged. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3514. Two young but regularly radial zoaria; the younger shows the beginning of ridges from the *cariosa* stage. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3539. Two compound zoaria (on slide), consisting of four layers of subcolonies with triangular ridges. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 3599. A well-preserved zoarium, with high, short ridges and a large, deep, flat central depression. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 5144. Two zoaria of var. *fusiformis*, like the figured specimen **D. 3510.** Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 5145. A young zoarium of the var. *sellula*; the base is flat and narrower than the upper surface of the disc which overhangs the vertical edge; the structure of the groups when seen from above agrees with that of Fig. 62 (**D. 3510**), but they extend for a shorter distance towards the middle of the disc. Maastrichter Kalk. Maastricht. Van Breda Coll.

D. 10,878. A zoarium, labelled "*Lichenopora elatior*, rare." Maastrichter Kalk. Maastricht. Gamble Coll.

UNREPRESENTED SPECIES.

1. boletiformis (d'Orbigny), 1854.

SYN. *Tecticavea boletiformis*, d'Orbigny, 1854. Bry. Crét. p. 991, pl. 781, figs. 8–12.
Radiocavea ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 43.
non Lichenopora boletiformis, Waters, 1884. Foss. Cycl. Austr.: Quart. Journ. Geol. Soc. vol. xl. p. 695, pl. xxxi. figs. 20, 21.
Lichenopora (*Radiocavea*) *diadema*, *pars*, Pergens, 1889. Rev. p. 382.

CHAR.—Zoarium growing in superposed groups, which remain isolated; radial groups of apertures alternately long and short, well raised above the interradial valleys.

DISTRIB.—Senonian: Ciply, Belgium.
Maastrichtian: Maastricht.

AFF.—The specimens from Aldinga referred to this species by Waters are described by him as forming confluent continuous sheets.

2. cribrosa, von Reuss, 1846.

SYN. *Lichenopora cribrosa*, von Reuss, 1846. Verst. böhm. Kr. p. 64, pl. xiv. fig. 10.

CHAR.—Wholly indeterminable.

DISTRIB.—Cenomanian: Bilin and Weisskirchlitz, Bohemia.

3. **elatior**, d'Orbigny, 1853.

Syn. *Lichenopora elatior*, d'Orbigny, 1853. Bry. Crét. p. 964, pl. 646, figs. 5–8.
,, ,, Pergens, 1890. Rev. p. 964.
Defrancia ,, Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 509.

Char.—Zoarium turbinate; attached by a small peduncle. Circular or subcircular in section. Upper surface bears about twenty-four radial ridges of biserial zoœcia. There are wide cancellate interspaces between the ridges.

Distrib.—Senonian—Maastrichtian: ? Pons and ? Pérignac, Charente-Inférieure.
Santonian: Saintes.
Coniacian: Villedieu, Vendôme, and les Roches, Loir-et-Cher; Joué, Indre-et-Loire.
Maune, Bougniaux, St. Léger, and Péguillac, Charente-Inférieure; Merpins and Moutier, Charente; Seine-Inférieure (*fide* Bucaille).
Turonian—Angoumian: Sougé and Trôo, Loir-et-Cher.

4. **elegans** (Michelin), 1844.

Syn. *Tubulipora elegans*, Michelin, 1844. Icon. Zooph. p. 123, pl. xxxii. fig. 6.
Defrancia ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 175.
,, ,, d'Orbigny, 1851. Bry. Crét. pl. 642, figs. 7, 8.
Radiocavea ,, d'Orbigny, 1853. *Ibid.* p. 965.
,, ,, Pergens, 1890. Rev. p. 384.

Char.—Zoarium a thin incrusting disc, with about sixteen raised radial bands, containing from two to four series of small apertures.

Distrib.—Cenomanian: Saint-Jean-la-Forêt, near Bellesme, Orne. Known only by Michelin's figures.

5. **elliptica** (d'Orbigny), 1853.

Syn. *Radiocavea elliptica*, d'Orbigny, 1853. Bry. Crét. p. 966, pl. 777, figs. 1–5.
Lichenopora (*Radiocavea*) *elliptica*, Pergens, 1890. Rev. p. 382.

Char.—Central area of irregular apertures, very large in proportion to the length of the radial bundles, of which there are about fourteen. The shape is elliptical in normal specimens. The apertures in the radii are usually biserial, with an occasional third aperture. (The shape in one of the specimens figured by d'Orbigny is irregular, it having grown around a cylindrical stem. Pergens remarks that some zoaria have the form of *Paricavea.*)

Distrib.—Senonian—Maastrichtian: Ste. Colombe, Manche.

6. **foveolata** (Marsson), 1887.

Syn. *Lopholepis foveolata*, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv. pt. i. p. 42, pl. iii. fig. 13.

Char.—Known from Marsson's figure of a worn, broken, thick zoarium; the apertures are irregularly distributed, but with indications of the radial bundles, which consist of from three to five indistinct series.

Distrib.—Senonian—Campanian: Rügen.

Aff.—The fragment figured by Marsson appears to be a worn fragment of a thick *Lichenopora*. The *Lopholepis* of von Hagenow is adnate and fasciculate, and so also is the *Multifascigera* of d'Orbigny. See pp. 50 and 67.

7. **fungiformis** (von Hagenow), 1846.

Syn. *Ceriopora fungiformis*, von Hagenow, 1846. In Geinitz, Grundr. Verst. vol. ii. p. 595, pl. xxiii b, fig. 9.
? *Defrancia* ,, Schlüter, 1870. Geogn. Pal. Reise südl. Schweden: N. Jahrb. p. 940.
? ,, ,, Osswald, 1890. Bry. Meckl. Kr.: Arch. Ver. Mecklenb. vol. xliii. p. 105.

Char.—Pedunculate with a flat base; tumid upper surface; the raised radial areas have biserial apertures.

Distrib.—Senonian—Campanian: Rügen; Balsberg in Scania; ? Mecklenberg.

Aff.—This species may be founded on the pedunculate form of *L. stellata*, but the original figure shows that the pores are biserial, and if so, the fact would be fatal to this suggestion.

8. **infundibuliformis,** Hennig, 1894.

Syn. *Lichenopora infundibuliformis*, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 35, pl. ii. figs. 31, 32.
? *Defrancia fungiformis*, Schlüter, 1870. Geogn. Pal. Reise südl. Schweden: N. Jahrb. p. 940.

Char.—Zoarium funnel-shaped, with a flat base and hollow upper surface. Height from 7 to 9 mm.; maximum diameter, 10 to 15 mm. Apertures of zoœcia ·07 mm., and grouped in irregular multiserial radial bands.

Distrib.—Senonian—Campanian: Zone of *Belemnitella mucronata*, Stafversvad; and beds with *Actinocamax mamillatus*, Balsberg, Sweden.

Aff.—This species is allied to *L. fungiformis*, differing by having a hollow instead of a tumid upper surface, and multiserial apertures in the radial groups.

9. **placenta** (von Reuss), 1872–3.

Syn. *Heteroporella placenta*, von Reuss, 1872–3. Bry. unt. Quad.: Palæontogr. vol. xx. pt. i. p. 134, pl. xxxiii. fig. 7.

Char.—Fixed by its whole base; convex above with a flattened top, around which occurs a single series of about seven large apertures. The outer slope is occupied by a peripheral zone of smaller apertures which are radially arranged. ? A young immature form.

Distrib.—Cenomanian—Lower Pläner: Plauen, Saxony.

10. **? radiata** (von Reuss), 1846.[1]

Syn. *Chrysaora radiata*, von Reuss, 1846. Verst. böhm. Kr. p. 64, pl. xiv. fig. 1.

Char.—Probably a Hydrozoan allied to *Neuropora*, but possibly a *Lichenopora*.

Distrib.—Cenomanian—Lower Pläner: Schillinge, near Bilin, Bohemia.

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[1] For *Lichenopora radiata*, Vine, see p. 33.

BIMULTICAVEA, d'Orbigny, 1853.

[Bry. Crét. p. 982.]

Diagnosis.

Radioporidæ with a compound zoarium growing as a massive lamellar incrustation. The zoœcia are arranged with their apertures in radial groups, which are slightly raised and are elliptical in shape, and have multiserial apertures. These sub-colonies are widely spaced, with wide margins of cancellate tissue.

Type Species.

Bimulticavea variabilis, d'Orbigny, 1853. Senonian: France.

Affinities.

This genus is a compound *Lichenopora*, with a massive lamellar zoarium.

UNREPRESENTED SPECIES.

1. **variabilis**, d'Orbigny, 1853.

Syn. *Bimulticavea variabilis*, d'Orbigny, 1853. Bry. Crét. p. 983, pl. 779, figs. 9–13.
Lichenopora (*Bimulticavea*) *variabilis*, Pergens, 1890. Rev. p. 383.

Char.—Sub-colonies have large, circular, central depressions, and the radial groups are short and triserial.

Distrib.—Senonian—Maastrichtian: Meudon, near Paris.

2. **simonowitschi**, nov. nom.

Syn. *Ceriopora stellata*, *pars*, Goldfuss, 1829. Petref. Germ. p. 85, pl. xxxi. fig. 1*c* (*non* figs. 1*a*, *b*).
Semimulticava goldfussi, Simonowitsch, 1871. Bry. Essen.: Verh. nat. Ver. preuss. Rheinl. vol. xxviii. pp. 34–6, pl. i. figs. 3*a*–*d*.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 226.
non Radiopora ,, von Reuss, 1866. Foram. Anth. Bry. deut. Sept.: Denk. Akad. Wiss. Wien, vol. xxv. p. 200, pl. x. figs. 11, 12.

Char.—Zoarium large, massive; Goldfuss' specimen is 45 mm. long by 18 mm. wide, with radial groups up to 6 mm. across. Each group has about eight spindle-shaped raised radial groups, with biserial apertures.

Distrib.—Cenomanian—Grünsand: Essen.

Aff.—This species was founded by Simonowitsch, who gave a long description of it, but his specific name *goldfussi* was preoccupied for an Oligocene species by von Reuss.

STELLOCAVEA, d'Orbigny, 1853.

[Bry. Crét. p. 967.]

SYNONYMS.

Stellocavea, d'Orbigny, 1853; Hamm, 1881; Ubaghs, 1879, 1888; Pergens, 1890; Ulrich, 1900; etc.
Carinifer, Hamm, 1881.

DIAGNOSIS.

Radioporidæ with a simple, adnate, discoid zoarium, in which the upper surface has radial ridges supported by a lamina, formed by an upgrowth from the under surface of the zoarium. The apertures open along the radial ridges, and are usually biserial.

TYPE SPECIES.

Stellocavea francqana, d'Orbigny. Maastrichtian: Maastricht.

AFFINITIES.

This genus is allied to *Lichenopora*, and differs from it by the prominence of the lamina, which occurs along the middle of each radial ridge; the existence of the lamina is indicated in the *cariosa* stage of *Lichenopora stellata*, but there it extends only a short distance into the zoarium from the margin of the disc.

The *Carinifer* of Hamm[1] is described by its author as discoid, and attached by the whole underside of the zoarium; as having numerous radial ridges, which are biserial, with apertures along the outer edge of the radii, and with the two series separated by a raised keel; and as having the middle of the zoarium and the interradial spaces marked by irregularly arranged pores. Hamm elsewhere accepts *Stellocavea* as distinct, but the description of his new genus does not appear to bring out any adequate ground for its separation, and his type species *C. trenkneri* may be included as a synonym of *S. francqana*.

Stellocavea francqana, d'Orbigny, 1853.

SYNONYMY.

Stellocavea francqana, d'Orbigny, 1853. Bry. Crét. p. 968, pl. 777, figs. 6–10.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 44.
,, ,, Ubaghs, 1888. C.R. Excursion: Bull. Soc. belge Géol. vol. i., Mém. pp. 221, 233.
,, ,, Pergens, 1890. Rev. p. 384.

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[1] Hamm. Bry. mastr. Ob.-Sen. i., Cycl. p. 27.

Stellocavea bipartita, Ubaghs, 1858. Neue Bry. Maestr.: Palæontogr. vol. v. p. 129, pl. xxvi. fig. 1.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 224.
,, ,, Ubaghs, 1888. C.R. Excursion: Bull. Soc. belge Géol. vol. i. p. 221.
,, *trifoliiformis*, Ubaghs, 1858. Neue Bry. Maestr.: Palæontogr. vol. v. p. 129, pl. xxvi. fig. 2.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 224.
,, ,, Ubaghs, 1888. C.R. Excursion: Bull. Soc. belge Géol. vol. i. p. 221.
Carinifer trenkneri, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 27.

DIAGNOSIS.

Zoarium circular, with a flat base and about seven primary ridges, and about twenty shorter secondary ridges.

DISTRIBUTION.

Senonian—Maastrichtian: Maastricht, Valkenberg, Petit-Lanaye.
Lower Maastrichtian: Glavant and Calcaire de Kunraed.

AFFINITIES.

Hamm includes as synonyms the *Stellocavea bipartita*, *trifoliiformis*, and *coronata* of Ubaghs. The Museum Collection includes two specimens which were acquired as *S. bipartita*, one of them having been identified as such by M. Pergens. . From inspection of those specimens I am prepared to follow Hamm's example.

Hamm's own *Carinifer trenkneri* seems to me to be only a synonym of this species. He describes it as oval and having about twenty-four radial ridges, which is approximately the same number as in *S. francqana*; the number is indefinite, as there is no distinct separation between the small teeth, which represent merely the beginnings of radial ridges and those which are large enough to be counted as ridges.

LIST OF SPECIMENS.

D. 3720. Half a zoarium of the typical form (on slide). Maastrichter Kalk. Valkenberg. Gamble Coll. Identified by M. Pergens.

D. 1350. A zoarium 6 × 5 mm. diameter (on slide). Maastrichter Kalk. Maastricht. Identified by Vine as *Stellocavea cultrata*, d'Orb., but it has neither of the characters of that species figured by d'Orbigny. Vine Coll.

D. 3757. A zoarium (on slide). Maastrichter Kalk. Valkenberg. Identified by M. Pergens as *Stellocavea bipartita*, Ubaghs. Gamble Coll.

B. 804. A zoarium of *S. francqana*, 6·5 mm. in diameter. Labelled *Stellocavea bipartita*. Maastrichter Kalk. Maastricht. Presented by Mrs. Burnett, May, 1882.

D. 3771. A broken zoarium (in tube), determined by M. Pergens as *Lopholepis irregularis* (Hag.). Maastrichter Kalk. Petit-Lanaye, Limburg. Gamble Coll.

UNREPRESENTED SPECIES.

cultrata, d'Orbigny, 1853.

SYN. *Stellocavea cultrata*, d'Orbigny, 1853. Bry. Crét. p. 969, pl. 777, figs. 11–13.
,, ,, Pergens, 1890. Rev. p. 384.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 44.

CHAR.—Zoarium with an irregular, serrated margin. About six long primary ridges and six shorter secondary ridges.

DISTRIB.—Senonian—Maastrichtian: Maastricht.

AFF.—Possibly only an irregular variety of the *S. francqana*.

ACTINOTAXIA, Hamm, 1881.

[Bry. mastr. Ob.-Sen. i., Cycl. p. 44.]

DIAGNOSIS.

Radioporidæ with a unilamellar or multilamellar zoarium, composed of round sub-colonies, which, though independent, have become fused. The central zoœcia of the sub-colonies are in radial biserial rows. The lamina between the two series in each row is thick, and projects above as a keel.

Smaller zoœcia scattered irregularly between the radial rows.

TYPE SPECIES.

Actinotaxia magna, Hamm. Senonian—Maastrichtian: Maastricht.

AFFINITIES.

This genus, which is of doubtful value, may be regarded as a compound *Stellocavea*. It has the carinate radii of that genus, but the zoarium is compound.

UNREPRESENTED SPECIES.

magna, Hamm, 1881.

SYN. *Actinotaxia magna*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 44.

CHAR.—Zoarium widely spread out. The sub-colonies are flat and plate-like, with a round depression in the middle of the upper side; the underside is flat, with a slightly projecting peduncle in the middle. Zoœcia wide and thick-walled. Apertures of the radial series large, elongated transversely, irregularly rectangular, crowded, flush. Between the radial rows are irregular, angular, smaller apertures.

DISTRIB.—Senonian—Maastrichtian: Maastricht.

APPENDIX TO *STELLOCAVEA*: THE CAMERAPORIDÆ.

The family Cameraporidæ of Meunier & Pergens, 1885, includes a series of specimens that are probably closely allied to *Stellocavea*. The specimens all came from the Maastrichtian of Limburg. The 'family' is not represented in the Museum Collection, and is of very doubtful value.

The following summary of the classification according to Meunier and Pergens shows the chief characters and variations of these Bryozoa. The members of the family have a circular zoarium, in which the zoœcia open in groups around the upper border of the disc; the groups are bounded by well-developed laminæ (as in *Stellocavea*).

CAMERAPORA, Meunier & Pergens, 1885.

SYN. *Camerapora*, Meunier & Pergens, 1885. Nouv. Bry. Crét. Sup.: Ann. Soc. malac. Belg. vol. xx., Mém. p. 34.

CHAR.—The zoœcia in the zoœcial groups occur in from four to six rows, with ten to twelve zoœcia in each. Each group continuous. Groups closely compressed.

TYPE SPECIES.—*C. recta*, Meunier & Pergens, 1885. *Op. cit.* p. 34, pl. ii. fig. 1.

1. **recta**, Meunier & Pergens, 1885.

SYN. *Camerapora recta*, Meunier & Pergens, 1885. *Op. cit.* p. 34, pl. ii. fig. 1.
,, ,, Ubaghs, 1888. C.R. Excursion: Bull. Soc. belge Géol. vol. i., Mém. p. 221.

CHAR.—Zoarium in plates, 10 to 14 mm. long, by 7 mm. wide. Lower surface smooth.

DISTRIB.—Senonian—Maastrichtian: Fauquemont and Glavant, Limburg.

2. **levinsseni**, Pergens, 1893.

SYN. *Camerapora levinsseni*, Pergens, 1894. Nouv. Bry. Crét. Limb.: Bull. Soc. belge Géol. vol. vii., Mém. p. 178, pl. ix. fig. 1.

CHAR.—Zoarium 5 to 7 mm. in diameter, with ten to twelve radial groups of apertures, with at least eight rows in each; part of the apertures closed by an epizoarial layer.

DISTRIB.—Senonian—Maastrichtian: Fauquemont, Limburg.

AFF.—Allied to *Camerapora recta*, Meunier & Pergens, but larger. Figure imperfect.

CLAUSACAMERAPORA, Meunier & Pergens, 1885.

CHAR.—The zoœcial groups are broken into dumbbell-shaped areas, owing to the ingrowth of the sides, which may unite and convert a zoœcial group into two detached groups of apertures.

TYPE SPECIES.—*C. mamillata*, Meunier & Pergens, 1885. Senonian—Maastrichtian: Limburg.

mamillata, Meunier & Pergens, 1885.

SYN. *Clausacamerapora mamillata*, Meunier & Pergens, 1885. Nouv. Bry. Crét. Sup.: Ann. Soc. malac. Belg. vol. xx., Mém. p. 35, pl. ii. figs. 2, 3.
,, ,, Ubaghs, 1888. C.R. Excursion: Bull. Soc. belge Géol. vol. i., Mém. p. 221.

CHAR.—Zoœcial groups including from sixteen to forty zoœcia. About eleven to fourteen groups on border of the zoarium.

DISTRIB.—Senonian—Maastrichtian: Third Bryozoan bed at Fauquemont and Glavant, Limburg.

CURVACAMERAPORA, Meunier & Pergens, 1885.

CHAR.—The laminæ which separate the groups of zoœcial apertures are strongly recurved and very thick.

TYPE SPECIES.—*C. cretacea*, Meunier & Pergens, 1885. Senonian—Maastrichtian: Limburg.

cretacea, Meunier & Pergens, 1885.

SYN. *Curvacamerapora cretacea*, Meunier & Pergens, 1885. *Op. cit.* p. 36, pl. ii. fig. 5.
,, ,, Ubaghs, 1888. C.R. Excursion: Bull. Soc. belge Géol. vol. i., Mém. p. 221.

CHAR.—Zoarium 1 cm. in diameter and 5 to 8 mm. high. Each group of apertures includes those of thirty to forty zoœcia, arranged in four to five rows. Five to nine groups to each zoarium.

DISTRIB.—Senonian—Maastrichtian: lowest bed at Fauquemont; and Glavant, Limburg.

TROCHILIOPORA,[1] Gregory, 1909.

[New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 65.]

DIAGNOSIS.

Radioporidæ with a simple top-shaped or capitate zoarium, composed of a constricted stem and expanded head.

Apertures in vertical series on the margin of the head.

TYPE SPECIES.

Trochiliopora humei, Greg. Upper Chalk: Gravesend.

AFFINITIES.

This genus is founded for two Cretaceous species, which are members of the Radioporidæ, as they are dimorphic and have the zoœcia arranged in radial groups. Its nearest ally is *Discocavea*, with which it agrees in having a simple zoarium, but differs by having a capitate zoarium.

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[1] From τροχιλία, a pulley, as the zoarium resembles a pulley-wheel and its axis.

It resembles *Tholopora* in its vertical rows of apertures, but that genus has a compound zoarium composed of superimposed sub-colonies. It differs from *Radiopora*, as that genus has a massive compound zoarium.

Trochiliopora humei,[1] Gregory, 1909.

SYNONYMY.

Trochiliopora humei, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 65.

DIAGNOSIS.

Zoarium fungiform, composed of a thick disc and stout, blunt stem. The diameter of the stem is nearly half that of the head. The lower end of the stem is longitudinally grooved, with linear pores. In the upper part of the stem the pores are irregularly arranged, and the intervening walls are reticular. Base of stem discoid.

The upper surface of the disc is flat; its central portion is large, with numerous irregularly arranged apertures of young zoœcia and mesopores. Margins vertical or well rounded, and marked by radial series of large apertures; there are three to four apertures in each series, and the series are separated by lines of cancelli.

DIMENSIONS.

	mm.
Height of zoarium	11
Diameter of head	7 × 6
Diameter of stem	2·5
Diameter of zoœcia	·4–·5
Diameter of apertures	·2–·25

DISTRIBUTION.

Upper Chalk—Zone of *Micraster coranguinum*: Gravesend.

FIGURES.

Pl. III. Fig. 2. The type-specimen. Upper Chalk: Gravesend. Fig. 2*a*, from the side; × 3 dia. Fig. 2*b*, the same from above; × 3 dia. ? Bowerbank Coll. **D. 2995.**

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[1] The species was named in MS. in 1899 in acknowledgment of the value of Dr. W. F. Hume's work on Cretaceous petrology, and his donations of Chalk Bryozoa to the Museum.

LIST OF SPECIMENS.

D. 2995. The type-specimen. Upper Chalk. Gravesend. ? Bowerbank Coll. Figd. Pl. III. Fig. 2.

D. 2994. A zoarium with broken stem. Upper Chalk. Gravesend. Bowerbank Coll.

UNREPRESENTED SPECIES.

clathrata (von Reuss), 1872–3.

Syn. *Discosparsa clathrata*, von Reuss, 1872–3. Bry. unt. Quad.: Palæontogr. vol. xx. pt. i. p. 111, pl. xxvii. fig. 4.

Defrancia multiradiata, von Reuss, 1872–3. *Op. cit.* p. 111, pl. xxvii. figs. 5, 6.

Char.—Zoaria simple, discoid, and conical; they may be gregarious, and thus incidentally form compound zoaria. The upper surface has a central depression lined with irregular, crowded zoœcia. From this central group pass off radial or subradial series. In one specimen of *D. multiradiata* the zoœcia are irregularly radial (von Reuss, *op. cit.* fig. 6; in fig. 5 the radial arrangement is well developed, and the aperture at the inner end of the series is the largest).

Distrib.—Cenomanian—Lower Pläner: Saxony (exact localities not stated).

Aff.—Both forms included in this species are described as rare, and the *D. clathrata* was founded on a single specimen. The two forms are probably the same, but the radial arrangement of the zoœcia is not so well shown in the *clathrata* as in the *multiradiata* of von Reuss.

THOLOPORA, nov. gen.

Synonyms.

Ceriopora, *pars*, Goldfuss, 1827; Michelin, 1846; d'Orbigny, 1850.
Radiopora, Simonowitsch, 1871.
Stellipora, *non* Hall, 1843; *pars*, von Hagenow, 1851.
Domopora, d'Orbigny, 1849, 1850, 1854; Hincks, 1880; *pars*, Vine, 1885.
Lichenopora, *pars*, Pergens & Meunier, 1887; Hennig, 1894.
Heteropora, Novak, 1877; Počta, 1892.
Defrancia, von Reuss, 1847; *pars*, Vine, 1885.

Diagnosis.

Radioporidæ in which the zoarium is compound, and consists of a series of superposed discs, or sub-colonies, forming short, thick, blunt, cylindrical stems. The zoarium may consist of one stem or of many stems rising from a broad incrusting base, forming a low tuft.

Each sub-colony consists of a central area crowded with mesopores; it is surrounded by a zone traversed by radial, uniserial rows of apertures, separated by lines of mesopores. Seen from the side the apertures occur in vertical series.

TYPE SPECIES.

Ceriopora clavata, Goldfuss: Petref. Germ. vol. i. 1827, p. 36, pl. x. figs. 15*a*, *b*, *non c–f*. A good section of the internal structure is given by Simonowitsch, Bry. Essen.: Verh. nat. Ver. preuss. Rheinl. vol. xxviii. 1871, pl. ii. fig. 2*c*.

This species seems the most suitable type, though *Ceriopora diadema*, selected as the type of *Domopora* by d'Orbigny, is a very different Bryozoan. D'Orbigny's conception of the genus is, however, well shown by his original diagnosis[1]: "*Domopora.* Ce sont des *Defrancia*, qui par le grand nombre de couches qui se succèdent forment un dôme, ou même une massue." This definition was repeated verbatim in 1852,[2] although with the omission of mention of the type species. In 1850 he had, however, also included[3] *Ceriopora diadema*, Goldfuss, pl. xi. fig. 12, in *Domopora*. D'Orbigny's diagnosis would apply to *D. clavata* or *D. stellata*, but is quite inapplicable to any of the Bryozoa included in Goldfuss' *C. diadema*, pl. xi. fig. 12; it would be more applicable to the specimen that Goldfuss figured on his pl. xxxvii. fig. 3, which is composed of a mass of superposed *Actinoporæ*; but they do not form a dome, a feature which is required in *Domopora* both by the name and by the diagnosis.

D'Orbigny's selection of Goldfuss' pl. xi. fig. 12, as the type of his *C. diadema* was unfortunate. Goldfuss gave six figures marked fig. 12, viz. Nos. *a–f*; they all represent simple, circular, flat colonies, which certainly belong to two species. According to von Hagenow (Bry. maastr. Kr. pp. 42, 43), Goldfuss' figs. *a–d* represent one species, which he names *Defrancia diadema*, and the figs. *e* and *f* represent another and new species, which he founded under the name *Defrancia michelini*. In this conclusion one detail was probably incorrect, as it appears clear from Goldfuss' description of his figures (Goldfuss, *op. cit.* p. 39) that fig. *d* is the lower side of the specimen shown in fig. *e*.

It is, however, clear that the *Ceriopora diadema*, Goldfuss, includes two species, which, according to the nomenclature adopted in this Catalogue, are—

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[1] D'Orbigny. Rev. Mag. Zool. ser. 2, vol. i. 1849, p. 502.

[2] D'Orbigny. Cours Élém. Paléont. et Géol. stratig.: Paléont. vol. ii. fasc. i. p. 107.

[3] D'Orbigny. Prod. Pal. vol. ii. p. 267.

Pl. xi. figs. *a*, *c* = *Lichenopora stellata* (= *Radiocavea reticulata*, d'Orb.,
non Hag.
Defrancia obvallata, Mars.).
Figs. *d*, *e*, ? *f* = *Actinopora diadema* (= *Defrancia michelini*, Hag.
Discotubigera michelini
(Hag.), d'Orb.).

D'Orbigny, in 1854, removed these species from *Defrancia* to a new genus *Radiocavea*; but he reversed von Hagenow's use of the name *diadema* as follows:—

Goldfuss.	Von Hagenow.	D'Orbigny.
Figs. *a–d*.	*Defrancia diadema*.	*Radiocavea reticulata*.
,, *e*, *f*.	,, *michelini*.	,, *diadema*.

To add to the confusion, d'Orbigny refers (p. 758) von Hagenow's *Defrancia michelini* to another genus, as *Discotubigera michelini*.

According to the usual system of nomenclature the type species named by the founder of the genus should fix the interpretation of the name; in that case the type species of *Domopora* should be one of the following:—

(1) *Actinopora diadema* (Goldf.), which includes Goldfuss' figures pl. xi. figs. 12*d*, *e*. This species is the *Radiocavea diadema* of d'Orbigny, excluding, however, from d'Orbigny's synonyms Hagenow, pl. iv. fig. 3, which is *Defrancia reticulata*, Hag. It also included the *Defrancia diadema*, Hag., *pars* (pl. iv. fig. 2, *non* fig. 3), and von Hagenow's *Defrancia michelini* (Hag. pl. iv. fig. 5).

(2) *Actinopora michelini* (Hag.), which, according to von Hagenow, included Goldfuss' figs. 12*e*, *f*, and is here regarded as a synonym of *Actinopora diadema*.

(3) *Lichenopora stellata* (Goldf.), which includes the *Radiocavea reticulata*, d'Orb. The latter species, according to d'Orbigny (Bry. Crét. p. 965), includes Goldfuss' figs. 12*a–c*, and also the *Defrancia obvallata*, Marsson, which was also founded on Goldfuss' figs. 12*a–c*, and included von Hagenow's specimen pl. iv. fig. 4, described by that author as a worn specimen of *Defrancia diadema*.

The name *Domopora* is quite unsuited to any of the above species, and none of them corresponds to the original diagnosis, which describes such a Bryozoon as that illustrated by d'Orbigny's figure of his *Domopora clavula* (= *clavata*, Goldf.), Bry. Crét.

pl. 647, figs. 2, 4, 7, or 8. It is therefore necessary either to disregard d'Orbigny's selection of *Ceriopora diadema*, Goldfuss, pl. xi. fig. 12, or, reducing *Domopora* to a synonym of *Lichenopora*, to found a new genus for the species ordinarily referred to it, with *Domopora clavata* as type. It is unfortunate that d'Orbigny selected a typical *Lichenopora* as the type species of *Domopora*; but since he did so, it seems necessary to adopt the latter alternative, both as the simplest course and as that required by the usual rules of nomenclature. The characteristic species of '*Domopora*' consequently require a new name, and *Tholopora*, which Dr. Bather suggests to me as a translation of *Domopora* (from θόλος, a dome), is therefore reluctantly proposed.

A fresh complication was introduced by Marsson, who suggested that von Hagenow accidentally inverted the numbers of figs. 3 and 4 on his pl. iv. Accordingly, the names to be attached to von Hagenow's figures should be as follows. The fourth column records names used in this Catalogue.

	Von Hagenow.	*Fide* Marsson.	Cat. Cret. Bry. 1909.
Pl. iv. fig. 1	*Defrancia disticha*, Hag.	*Defrancia disticha*, Hag.	*Actinopora disticha* (Hag.).
2	*Defrancia diadema*, Goldf.	*Defrancia diadema*, *pars* (Goldf.)	*Actinopora diadema* (Goldf.).
3	*Defrancia diadema*, Goldf.	*Discocavea reticulata* (Hag.)	*Discocavea irregularis* (d'Orb.).
4	*Defrancia reticulata*, Hag.	*Defrancia obvallata*, Mars.	*Lichenopora stellata* (Goldf.).
5	*Defrancia michelini*, Hag.	*Defrancia michelini*, Hag.	*Actinopora diadema* (Goldf.).

The type species of the five associated genera may then be taken as follows:—

Tholopora clavata (Goldf.).
Lichenopora turbinata, Defr., figs. 12*a–c*.
Radiopora formosa, Mich.
Discocavea irregularis, d'Orb.
Actinopora stellata (Koch & Dunker).

Vine, in 1885,[1] included many species of *Defrancia* in *Domopora*, but they do not correspond to the diagnosis of *Domopora* which he accepted.

1. **Tholopora clavata** (Goldfuss), 1827.

Synonymy.

Ceriopora clavata, Goldfuss, 1827. Petref. Germ. vol. i. p. 36, pl. x. figs. 15*a*, *b*, *non c–f*.[2]
,, ,, Römer, 1840. Verst. nordd. Kr. p. 22.
,, ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 278.
Stellipora ,, von Hagenow, 1851. Bry. maastr. Kr. p. 44.
non Heteropora clavata, Busk, 1859. Crag Polyz. p. 123, pl. xix. fig. 7.
,, ,, ,, Canu, 1904. Bry. Tert. recueillis Thomas Sud Tunisie: Explor. Sci. Tunisie, p. 29, pl. xxxv. figs. 45–7.
Radiopora clavata, Simonowitsch, 1871. Bry. Essen.: Verh. nat. Ver. preuss. Rheinl. vol. xxviii. p. 40, pl. ii. figs. 2*a–c*.
? ,, ,, Bucaille, 1890. Bry. Crét. Seine-Inf.: Bull. Soc. Sci. nat. Rouen, vol. xxv. p. 512.
Domopora ,, d'Orbigny, 1854. Bry. Crét. p. 988.
? Ceriopora clavula, Michelin, 1846. Icon. Zooph. p. 207, pl. lii. fig. 8.
Domopora ,, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 176.
,, ,, d'Orbigny, 1854. Bry. Crét. p. 989, pl. 647, figs. 1–11.
? ,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 43.
? ,, ,, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv. p. 41.
? Lichenopora clavula, Pergens & Meunier, 1887. Bry. gar. Faxe: Ann. Soc. malac. Belg. vol. xxi., Mém. p. 230.
? ,, ,, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 34.
Radiopora elegans, Simonowitsch, 1871. *Op. cit.* p. 38, pl. ii. figs. 1*a–e*.

Diagnosis.

Zoarium erect, and usually cylindrical and clavate, but somewhat fungiform in young specimens; of from three to about six regularly superimposed zoœcial groups. The centre of the upper surface is depressed, and the floor of the depression is formed of irregularly arranged, crowded zoœcia. From this area radiates a series of regular, straight, or slightly curved uniserial rows, containing up to about seventeen apertures in each. The radial rows of apertures are separated by broad interradial bands of mesopores.

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[1] G. R. Vine. Fifth Report: Rep. Brit. Assoc. 1884, pp. 150, 151.

[2] These figures are of a Jurassic fossil, probably a Hydrozoan.

DIMENSIONS.

	Type of Goldfuss. mm.	D'Orbigny, pl. 747. mm.
Height of zoarium	10	7–8
Diameter of zoarium	4	4–5
Number of sub-colonies	6	4–6
Diameter of apertures	about ·1	·1–·15

DISTRIBUTION.

Cenomanian: Le Mans, Sarthe; Essen; Île Madâme, Charente-Inférieure.
? Danian: Faxoe and Annetorp.
? Senonian—Campanian: Zone of *Belemnitella mucronata*, Köpinge; beds with *Actinocamax mamillatus*, Balsberg, Karlshamm, and Gropemöllan.

AFFINITIES.

D'Orbigny by mistake referred the horizon of Goldfuss' *clavata* to the Senonian instead of to the Cenomanian; and he adopted the name *clavula* (probably from Michelin, though giving no reference to that author) for the Cenomanian species. The two specimens so well figured by d'Orbigny as *D. clavula* are no doubt the same as Goldfuss' *clavata*; but whether the *C. clavula* of Michelin is the same species is doubtful.

MM. Pergens & Meunier identified some specimens with unbranched stems, 2–3 mm. in diameter, from the Danian of Faxoe, as this species; but as they consider that *Domopora truncata* (Flem.)[1] may also belong to the species, their record is not convincing. Hennig has described specimens of probably the same form from both the Danian and Senonian of Scania, and as the apertures are ·06 mm. in diameter, or about half the average size of those in the typical form, the Danian and Senonian specimens are a distinct variety or species.

The specimen from the Miocene of Djebel Nasser-Allah in Southern Tunisia, identified as *H. clavata* by M. Canu and illustrated by some excellent photographs, appears to me quite distinct from the Bryozoon described by Goldfuss; the Tunisian specimens show neither the zonal arrangement nor the vertical series of apertures of the Essen species.

Busk, in 1859, recorded the species from the Pliocene (the Suffolk Crag), as he thus identified a clavate *Heteropora*; his generic identification of the Crag fossil seems correct, so that the species is quite distinct from the Cenomanian *Tholopora*.

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[1] See e.g. *Domopora stellata*, Hincks, 1880. Brit. Mar. Polyz. p. 481, pl. lxiii. figs. 10–14.

LIST OF SPECIMENS.

D. 3628. A stout zoarium, 6 mm. long and 5 mm. diameter. Cenomanian—Essener Grünsand. Essen. Old Coll.

D. 3620. A specimen 14 mm. long by 5 mm. in diameter, and with strongly annulated stem. The rows of apertures are short, containing only from six to seven. Cenomanian—Essener Grünsand. Essen. Old Coll.

D. 3684. A small zoarium, 4 mm. in diameter and 3½ mm. high, with from twelve to fourteen apertures in the longest vertical series. A small central axial group of equal zoœcia. Cenomanian. Le Mans. Tesson Coll.

D. 3686. Seven zoaria and fragments (in tube). One has a spherical top with a fragment of the peduncle; it is 4 mm. in diameter and 3 mm. high, and has seventeen apertures in the vertical series. The largest specimen is 5·5 mm. high, 3 mm. in diameter; it has a young zoarium attached to it, 1½ mm. in diameter, with distinct radial arrangement of apertures. Cenomanian. Le Mans. Tesson Coll.

2. **Tholopora muletiana** (d'Orbigny), 1850.

Synonymy.

Ceriopora muletiana, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 121.
Domopora ,, d'Orbigny, 1854. Bry. Crét. p. 988, pl. 781, figs. 1–4.
,, ,, *pars*, Osswald, 1890. Bry. Meckl. Kr.: Arch. Ver. Mecklenb. vol. xliii. p. 105.

Diagnosis.

Zoarium consists of a large knob-shaped cluster of zoœcial groups, on a short, cylindrical, constricted stem. Centres of sub-colonies consist of depressed area occupied by apertures all equal in size. About six to eight apertures in each radial row. Mesopores large.

Distribution.

Aptian: Les Croûtes, Aube; Gurgy, Yonne; Vassy, Haute-Marne.
Hauterivian: Cressier, near Neuchatel.

Affinities.

This species is allied to *R. bosquetiana* (Hag.) by its zoarial form, but differs in the smaller number of apertures in the radial rows and in the marked constrictions on the stem. The species has some resemblance to *Radiopora*, owing to the massive expansion at the upper end of the stem; but the zoarium is still clavate, and thus belongs to *Tholopora.*

LIST OF SPECIMENS.

D. 3656. Three zoaria (in tube). The longest is 13 mm. long and 3 to 5 mm. in diameter, and has an annulated stem; the zoarium is only sub-clavate, as it expands rather gradually upward. There are eight apertures in each vertical series. The second zoarium is clavate, and is 10 mm. high and 3 to 4½ mm. in diameter. The third zoarium is a sub-cylindrical annulated stem, only slightly expanded at the upper end. Hauterivian. Cressier, near Neuchatel. Bruckmann Coll.

D. 3659. A clavate zoarium, 13 mm. high, 7 × 4 mm. in diameter; the top is bilobed. Hauterivian. Cressier, near Neuchatel. Bruckmann Coll.

D. 3658. A zoarium with two thin slides cut from it. Hauterivian. Cressier, near Neuchatel. Bruckmann Coll.

D. 3657. A small specimen mounted on slide. Hauterivian. Cressier. Bruckmann Coll.

3. **Tholopora colligata**[1] (Gregory), 1909.

SYNONYMY.

Domopora colligata, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 65.

DIAGNOSIS.

Zoarium large and irregular; from the upper side it appears tubercular and massive. On a side view it is seen to be composed of numerous columns which are often attached, giving the zoarium a massive aspect like a *Radiopora.* The sub-colonies are distinct and thick.

Apertures irregular in the centres of the sub-colonies, but become radial and vertical on the sides. In the lower sub-colonies the regular arrangement of the apertures is obscure, as most of the apertures in the vertical series are covered by the overgrowth of the upper sub-colony.

DIMENSIONS.

	mm.
Height of zoarium	20
Diameter of zoarium	32
Thickness of sub-colonies	2–1
Diameter of sub-colonies	3–4
Diameter of apertures	about ·2
Diameter of mesopores	about ·09

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[1] From *colligare*, 'to bind together'; from the close attachment of the constituent columns of the zoarium.

Distribution.

Lower Greensand: Farringdon, Berkshire.

Figures.

Pl. IV. Fig. 7*a*. The type-specimen from above; nat. size. Fig. 7*b*, the top of one of the vertical columns; × 8 dia. Lower Greensand: Farringdon. (? Baker Coll.) **D. 7288.**

Fig. 73*a*. The side view of the same specimen; nat. size.

Fig. 73*b*. One column of sub-colonies; × 6·9 dia. **D. 7288.**

Affinities.

This species has a massive aspect, and resembles the *Radiopora tuberculata* from the French Cenomanian and Cambridge Greensand; but the species is a *Tholopora*, its zoarium being built of columns composed of numerous bun-shaped sub-colonies. Its nearest ally is *Tholopora virgulosa*, from which it differs by its more massive zoarium, that species being essentially tufted or sub-dendroid.

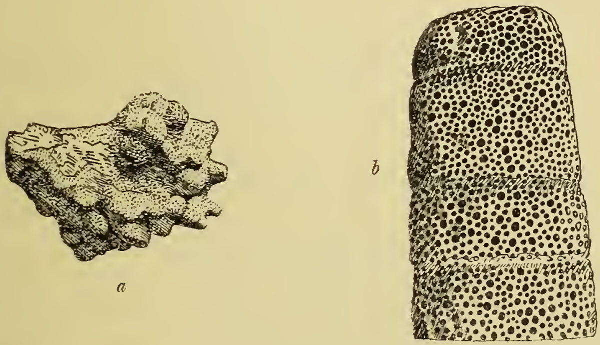

Fig. 73.—*Tholopora colligata*. *a*, zoarium from the side, nat. size; *b*, side-view of one column, × 6·9. **D. 7288.**

It is allied in age and by its massive appearance to *Tholopora muletiana* (d'Orb.), but differs from that species by the absence of the central depressed series of zoœcia free from mesopores, and the less perfect radial series of apertures.

D. 7288. The type-specimen. Lower Greensand. Farringdon. (? Baker Coll.) Figd. Pl. IV. Fig. 7 and Figs. 73*a* and *b*.

4. **Tholopora vinei** (Gregory), 1909.

SYNONYMY.

Domopora polytaxis (Hag.)?, Vine, 1885. Cambr. Greensd.: Proc. Yorks. Geol. Soc. vol. ix. p. 21.
,, ,, ,, ? Vine, 1889. Further on Cambr. Greensd. pt. ii.: *ibid.* vol. xi. pt. ii. pp. 258, 270.
,, ,, ,, ? Vine, 1891. Rep. Cret. Polyz.: Rep. Brit. Assoc. 1890, p. 389.
,, *vinei*, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 66.

DIAGNOSIS.

Zoarium small, of two or more stems arising from a circular base. The stems are sharply divided by transverse annular constrictions into several segments, which decrease in diameter towards the blunt apex.

Apertures in vertical series, containing from two to five in each series. The apertures in the series are in places well raised above the general surface of the stem.

Mesopores scarce.

DIMENSIONS.

	mm.
Height of zoarium	5
Maximum diameter of stems	2–3
Maximum diameter of zoarium at base	4
Diameter of apertures...	·15

DISTRIBUTION.

Albian—Cambridge Greensand: Cambridge.

FIGURES.

Pl. VII. Fig. 8. The type-specimen from the side; × 5 dia. Cambridge Greensand: Cambridge. Vine Coll., No. 22. **D. 1879.**

Pl. VIII. Fig. 1. Part of the surface of another specimen, showing some of the raised apertures; × 15 dia. Cambridge Greensand: Cambridge. **D. 1881.**

AFFINITIES.

This species is based on two specimens from the Cambridge Greensand, doubtfully identified by Vine as the *Ceriopora polytaxis* of von Hagenow,[1] which in its overlapping layers somewhat resembles a *Tholopora.* The *C. polytaxis*, however, has not the vertical series of apertures and mesopores of *Tholopora.*

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[1] Von Hagenow. Bry. maastr. Kr. 1851, p. 51, pl. v. fig. 2.

LIST OF SPECIMENS.

D. 1879. The type-specimen. Cambridge Greensand. Cambridge. The specimen identified by Vine as *D. polytaxis*. Jesson Coll. Figd. Pl. VII. Fig. 8.

D. 1881. Another specimen similarly identified by Vine. Cambridge Greensand. Cambridge. Jesson Coll. Figd. Pl. VIII. Fig. 1.

5. **Tholopora virgulosa**[1] (Gregory), 1909.

SYNONYMY.

Ceriopora stellata, pars, Goldfuss, 1829. Petref. Germ. p. 85, pl. xxx. fig. 12, *non* pp. 39 and 85, pl. xi. fig. 11, pl. xxxi. figs. 1*a–c*.
non ,, ,, Koch & Dunker, 1840. Beitr. nordd. Ool. p. 55, pl. vi. fig. 12.
,, ,, ,, Philippi, 1843. Beitr. Tertiärverst. nordwestl. Deutschl. pp. 36, 37.
,, ,, *pars*, von Hagenow, 1846. In Geinitz, Grundr. Verst. vol. ii. p. 595.
,, ,, ,, Boll, 1852. Geogn. Mekl.: Arch. Ver. Naturg. Meklenb. vol. vi. p. 63.
,, ,, ,, Kade, 1852. Los. Verst. Schanzenb. p. 32.
Heteropora (*Ceriopora*) *stellata, pars*, Römer, 1840. Verst. nordd. Kr. p. 23.
non Stellipora stellata (on Goldfuss' pl. xxxi. fig. 1*c*), von Hagenow, 1851. Bry. maastr. Kr. p. 44.
Domopora stellata, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 267.
non ,, ,, d'Orbigny, 1854. Bry. Crét. p. 988.
,, ,, ,, Busk, 1856. Polyz. Norway and Finm.: Ann. Mag. Nat. Hist. ser. 2, vol. xviii. p. 36, pl. i. fig. 9.
,, ,, ,, Hincks, 1880. Hist. Brit. Mar. Polyz. p. 481, pl. lxiii. figs. 10–14.
,, *Defrancia stellata*, von Reuss, 1847. Foss. Polyp. Wien, Tertiärbeck.: Nat. Abh. vol. ii. pt. i. p. 37, pl. vi. fig. 2.
,, ,, ,, Manzoni, 1878. Bry. foss. Mioc. Austr. Ungh. pt. iii.: Denk. Akad. Wiss. Wien, vol. xxxviii. pt. ii. p. 16, pl. xvi. fig. 63.
Radiopora ,, Simonowitsch, 1871. Bry. Essen.: Verh. nat. Ver. preuss. Rheinl. vol. xxviii. p. 43, pl. ii. figs. 3*a–d*.
,, ,, von Reuss, 1872. Bry. unt. Quad.: Palæontogr. vol. xx. pt. i. p. 128, pl. xxxi. figs. 12–14; pl. xxxii. figs. 1-5.
Lichenopora (*Radiopora*) *stellata*, Ulrich, 1900. In Zittel-Eastman, Textbook Palæont. vol. i. p. 265, fig. 431.
Ceriopora cavernosa, pars, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 36.
,, ? sp. Lang, 1903. Foss. Bed, Charmouth: Geol. Mag. dec. iv. vol. x. p. 391.
Domopora virgulosa, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 66.

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[1] From its tufted form.

DIAGNOSIS.

Zoarium sub-dendroid, or tufted; it grows either in numerous short branches from a broad base, with the branches bifurcating occasionally, or as cylindrical branches, which may either give off above many sub-branches or expand distally into irregular lobes; or the main stem may expand into a thickened body giving off above small cylindrical stems. Sides marked by annular constrictions.

The end consists of a group of crowded, irregularly arranged zooecia, surrounded by the radial series, which pass into the vertical marginal series.

DIMENSIONS.

	Goldfuss' pl. xxx. fig. 12. mm.	Simonowitsch. mm.
Height of zoarium	13 ...	19
Width of zoarium	about 15 ...	25
Diameter of a branch	about 1·75–3·5 ...	5

DISTRIBUTION.

BRITISH:

Upper Greensand: Warminster, and Chute Farm, near Warminster, Wilts.
Zone of *Schlœnbachia rostrata*: The Cutting, Black Ven, Charmouth.

FOREIGN:

Cenomanian: Essen.
Lower Quader: Plauen, Saxony.

AFFINITIES.

This species has to be renamed, for it is part of the *Ceriopora stellata* of Goldfuss, and it is the part which he figured and described in 1829; his name has to be retained for the species to which he applied it in 1827, which is a *Lichenopora* (see p. 252).

Von Reuss has referred to this species a small Miocene (Leithakalk) and Oligocene fossil, which he subsequently transferred to *Radiopora* and named *R. goldfussi*,[1] as he recognized its specific distinction from *Domopora stellata*.

The species was subsequently described by Manzoni (1878) from the Austrian Miocene, but his figure shows that this Miocene fossil is very different from the Cretaceous species. *Domopora*

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[1] A. E. von Reuss. Foram. Anth. Bry. deut. Sept.: Denk. Akad. Wiss. Wien, vol. xxv. (1866), p. 200, pl. x. figs. 11, 12.

stellata has been identified as living by Hincks, but on what appears inadequate foundation.

Goldfuss figured and described four distinct Bryozoa as *Ceriopora stellata.* The arrangements of these species, according to von Reuss[1] and as accepted in this Catalogue, are as follows:—

Goldfuss.	*Apud* von Reuss.	B.M. Catalogue, 1909.
Pl. xxxi. figs. 1*a* and *b*	*Ceriopora substellata* (d'Orb.)	= *Reptomulticava substellata* (d'Orb.).
Pl. xxxi. fig. 1*c*	*Semimulticava goldfussi*, Sim.	= *Bimulticavea simonowitschi*, Greg.
Pl. xxx. fig. 12	*Radiopora stellata* (Goldf.)	= *Tholopora virgulosa* (Greg.).
Pl. xi. fig. 11	*Radiopora* sp.	= *Lichenopora stellata* (Goldf.).

LIST OF SPECIMENS.

British.

D. 11,833. Type-specimen: a zoarium with knobby, blunt, well-separated branches, showing the structure well. Upper Greensand. Warminster, Wilts. Cunnington Coll.

D. 7289. Two zoaria similar to the type-specimen. Upper Greensand. Warminster, Wilts. Cunnington Coll.

D. 3175. Three smaller forms; the finer branches show the ends. Upper Greensand. Chute Farm, Warminster. Mantell Coll.

10,111. One much worn zoarium. Upper Greensand. Chute Farm, Warminster. Mantell Coll.

D. 3180. A zoarium with a concave hollow base; the upper surface is mammillated. The zoarium is 30 × 32 mm. in diameter and 11 mm. in thickness; the height above a line across the base is 23 mm. Upper Greensand. Warminster. Baker Coll.

D. 7183. A zoarium, 7 mm. high and 8–9 mm. in diameter; the base is narrow, and the zoarium thickens above to a somewhat square mass with sides 6·5 mm. long; four stems, each 2–2·5 mm. in diameter, are situated on the upper surface, one at each corner. Upper Greensand—zone of *Schlœnbachia rostrata.* The Cutting, Black Ven, Charmouth, Dorset. Presented by W. D. Lang, Esq., 1903. The specimen is that referred to by Lang (loc. cit. 1903) as *Ceriopora* (?).

Foreign.

D. 3632. Four young zoaria. Cenomanian — Essener Grünsand. Essen. Old Coll.

D. 3634. A worn, flat zoarium, 28 mm. in diameter and 10 mm. high, with the beginning of three primary branches. Essener Grünsand. Essen. Bruckmann Coll.

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[1] Bry. unt. Quad. pt. ii.: Palæontogr. vol. xx. pt. i. (1872), p. 125.

D. 3633. A zoarium which begins with a flat base, 8 mm. long and 3 mm. wide, giving off two primary branches, both of which fork. The zoarium appears to have been attached to the stem of some organism. Two slides with vertical and transverse sections, cut from the same. Essener Grünsand. Essen. Old Coll.

D. 3623. One zoarium with base 8 mm. in diameter giving off six primary branches. The whole tuft is 22 × 23 mm. in diameter and 17 mm. high. Essener Grünsand. Essen. Bruckmann Coll.

D. 3630. A zoarium with branches so crowded that they give the fossil a nodular aspect; the branches are in very regular series. There are six apertures in each radial series. Essener Grünsand. Essen. Bruckmann Coll.

6. **Tholopora novaki** (Gregory), 1909.

SYNONYMY.

Heteropora variabilis (*non* d'Orb.), Novak, 1877. Bry. böhm. Kr.: Denk. Akad. Wiss. Wien, vol. xxxvii. pt. ii. p. 116, pl. ix. figs. 10–20.

,, ,, Počta, 1892. Mech. Koryc. Hory: Ces. Akad. Fr. Jos. Praze, sect. ii. pp. 25, 33.

Domopora novaki, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 66.

DIAGNOSIS.

Zoarium usually clavate, with a large lobed head and annular peduncle, tapering towards the base; but also found massive, with numerous stems rising from a broad incrusting base.

Zoarium of many layers, up to about ten in number.

Mesopores scarce; about as many as the zoœcia, or slightly more numerous.

Apertures, about six in each vertical series.

DIMENSIONS.

	mm.
Height of zoarium	1–12
Diameter of zoarium	3–5

DISTRIBUTION.

Cenomanian—Korycaner Schichten: Kamajk, Zbislav, Kolin, Kank, and Jiné, Bohemia.

AFFINITIES.

This species was identified by Novak with the ***Multicrescis variabilis***, d'Orb.,[1] and the two species are essentially the same in the form of the zoarium; but the series of specimens in the Museum shows that the Bohemian species has the vertical and radial lines of apertures of *Tholopora*, and that there is a distinct species having the same habit, but with the apertures irregularly arranged. The latter is a true *Multicrescis*; such a form from the Haldon Hills is represented on Pl. V. Fig. 6.

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[1] Bry. Crét. p. 1077, pl. 800, figs. 3–7.

The Trepostomatous structure of the zoarium is well shown in the sections figured by Novak (*op. cit.* pl. ix. figs. 19, 20).

LIST OF SPECIMENS.

D. 4441. Three zoaria. Six apertures in the vertical series. Cenomanian—Korycaner Schichten. Kamajk, Bohemia. Purchased of Dr. Anton Frič.

D. 4440. Three zoaria. Cenomanian—Korycaner Schichten. Zbislav, Bohemia. Purchased of Dr. Anton Frič.

7. **Tholopora cantiana** (Gregory), 1909.

SYNONYMY.

Multicrescis variabilis, *non* d'Orb., Gamble, 1896. Cat. Bry. Chatham, p. 4.
Domopora cantiana, Gregory, 1909. New Cret. Bry.: Geol. Mag. dec. v. vol. vi. p. 66.

DIAGNOSIS.

Zoarium small, of stems which are circular in section and marked by numerous horizontal annular constrictions.

The upper segments gradually decrease in diameter, and the zoarium ends in a blunt point.

Apertures in short vertical series, including from two to six apertures in a series.

Mesopores scanty.

DIMENSIONS.

	D. 2849.	D. 2759.
	mm.	mm.
Height of zoarium	more than 5 ...	4
Maximum diameter of zoarium ..	2·4 ...	2·2
Diameter of apertures	·15–·20 ...	·15–·20

DISTRIBUTION.

Upper Chalk—Zone of *Micraster coranguinum*: Bromley, Kent.
Middle Chalk—Zone of *Micraster cortestudinarium*: Chatham.

FIGURES.

Pl. VIII. Fig. 2. A zoarium from the side; × 5 dia. Upper Chalk: Bromley. J. Simmons Coll. **D. 2849.**

Pl. VIII. Fig. 3. The type-specimen from the side; × 5 dia. Middle Chalk—Zone of *Micraster cortestudinarium*: Chatham. Vine Coll. **D. 2759.**

AFFINITIES.

This species is based on specimens from the Chalk of Kent, some of which had been identified as *Multicrescis variabilis*; the records of that species in Vine's published reports, however, refer to other species from the Lower Greensand and Red Chalk. The species is allied to *Tholopora clavata* by its cylindrical constricted stem; but in *T. cantiana* the zoarium is smaller and the constrictions are much deeper, the number of apertures in a restricted series is smaller, and the zoarium tapers upward to a blunt point.

LIST OF SPECIMENS.

D. 2759. The type-specimen (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll. Figd. Pl. VIII. Fig. 3.

D. 2849. A paratype (on slide). Upper Chalk. Bromley, Kent. J. Simmons Coll. Figd. Pl. VIII. Fig. 2.

D. 4208. Three zoaria (on slide). Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

D. 715. A zoarium (on slide), labelled *Multicrescis variabilis*. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Vine Coll. (No. 67, 28 G).

D. 410. A specimen with flattened upper surface. Middle Chalk—zone of *Micraster cortestudinarium*. Chatham. Gamble Coll.

RADIOPORA, d'Orbigny, 1849.

[Gen. nouv. Bry.: Rev. Mag. Zool. ser. 2, vol. i. 1849, p. 502.]

SYNONYMS.

Ceriopora, *pars*, Goldfuss, 1827; Michelin, 1846; von Hagenow, 1846; Kade, 1852; etc.
Heteropora, *pars*, Römer, 1839, 1840.
Polytrema, *pars*, d'Orbigny, 1850.
Stellipora (*non* Hall, 1843), von Hagenow, 1851; Winkler, 1864.
Semimulticavea, d'Orbigny, 1854; Keeping, 1883.
Lichenopora, *pars*, Pergens, 1890; Hennig, 1894.
Domopora, *pars*, d'Orbigny, 1854; Ubaghs, 1879; Hamm, 1881.

DIAGNOSIS.

Radioporidæ with a massive zoarium which is multilamellar in structure. The zoœcia are arranged in radial series; the rows are uniserial, and are separated by wide areas of mesopores. The radial arrangement is sometimes obscure.

TYPE SPECIES.

Radiopora formosa (Michelin), d'Orbigny, 1849. Cenomanian: France.

AFFINITIES.

This genus is the culminating form of a long series beginning with the simple discoid *Discocavea*, and including *Tholopora*, which is composed of cylindrical stems made up of superimposed sub-colonies, and the arborescent *Radiocavaria*.

One species that may belong to *Radiopora* has the radial arrangement of the apertures imperfectly developed; but as a rule the surface of the zoarium is marked by conspicuous stellate groups of round apertures.

1. **Radiopora formosa** (Michelin), 1846.

SYNONYMY.

Ceriopora formosa, Michelin, 1846. Icon. Zooph. p. 206, pl. lii. fig. 6.
Radiopora ,, *pars*, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 176.
,, ,, d'Orbigny, 1854. Bry. Crét. p. 996, pl. 782, figs. 1, 2.
Stellipora ,, von Hagenow, 1851. Bry. maastr. Kr. p. 44.

DIAGNOSIS.

Zoarium large, with an expanded incrusting base, and a short constricted stem which expands above into a large mass, bearing numerous thick, knobbed, or pointed branches.

Apertures in conspicuous radial groups, with about four apertures in each radial row.

DIMENSIONS.

	Michelin's type. mm.
Height of zoarium	over 28
Diameter of zoarium	36
Diameter of base	21
Diameter of stem above base	15
Diameter of radial group	3–5

DISTRIBUTION.

BRITISH:
Upper Greensand: Maiden Bradley (two specimens).
FOREIGN:
Cenomanian: Le Mans.

AFFINITIES.

This species is the type of the genus. It is not, however, very well known; it must be rare in France, as d'Orbigny copied

Michelin's figure, and with the exception of the Maiden Bradley specimens, the species is known only by that figure.

D. 11,829–30. Two specimens from the Upper Greensand of Maiden Bradley.

2. **Radiopora neocomiensis** (d'Orbigny), 1850.

SYNONYMY.

non Heteropora tuberosa, Römer, 1840. Verst. nordd. Kr. p. 23 (*fide* d'Orbigny).
,, *Ceriopora* ,, Michelin, 1846. Icon. Zooph. p. 208, pl. liii. fig. 1.
,, ,, ,, von Hagenow, 1846. In Geinitz, Grundr. Verst. vol. ii. p. 507.
,, *Radiopora* ,, d'Orbigny, 1852. Prod. Pal. vol. iii. p. 138.
,, *Polytrema subtuberosa*, d'Orbigny, 1850. *Ibid.* vol. ii. p. 94.
Monticulipora neocomiensis, d'Orbigny, 1850. *Ibid.* p. 95.
Radiopora heteropora (excl. three synn.), d'Orbigny, 1854. Bry. Crét. p. 993, pl. 781, figs. 13–16.
,, ,, de Loriol, 1863. Invert. Mt. Salève, pt. ii. p. 143, pl. xviii. fig. 3.
,, ,, *pars*, Etheridge & Newton, 1878. Cat. Cret. Foss. Mus. Pract. Geol. p. 7.
,, ,, Canu, 1902. Bry. foss. i., Coll. Camp.: Bull. Soc. géol. France, ser. 4, vol. ii. p. 12.
Lichenopora (*Radiopora*) *heteropora* (excl. three synn.), Pergens, 1890. Rev. p. 383.
Ceriopora cavernosa (*non* Hag.), Etheridge & Newton, 1878. Cat. Cret. Foss. Mus. Pract. Geol. p. 6.
Ceriopora (*Multicrescis*) *mammillosa*, *pars*, Etheridge & Newton, 1878. *Ibid.* p. 6.

DIAGNOSIS.

Zoarium irregularly hemispherical, or with the hemispherical upper part of the zoarium raised on a cylindrical base, the sides of which are banded by the outcrop of the successive layers. The upper surface is covered with regular mamelons.

Each mamelon has a porous centre, from which radiates a regularly radial series of apertures.

DIMENSIONS.

	D'Orbigny's type. mm.
Height of zoarium	13
Diameter of zoarium	15 × 17
Diameter of radial groups	3

DISTRIBUTION.

BRITISH:

Lower Greensand: Farringdon, Berkshire.

FOREIGN:

Neocomian: Géovressiat, near Nantua, Ain; Vassy, Fontenoy, and Chenay, Yonne; Baudrecourt, Haute-Marne; Sainte-Croix, Vaud; Mont Salève, Switzerland.

FIGURES.

Fig. 74. Part of a vertical section; × 8 dia. Lower Greensand: Farringdon, Berkshire. Old Coll. **D. 3143.**

Fig. 75. Part of a horizontal section cut from the same zoarium; × 10 dia. Old Coll. **D. 3143.**

AFFINITIES.

The difficulty with this species is its relation to the species founded by Römer as *Alveolites heteropora*, and here regarded as a *Reptomulticava*. D'Orbigny in 1854 regarded that species as synonymous with his *Monticulipora neocomiensis*, and figured an excellent specimen, which he identified as *Radiopora heteropora*. The specific name *neocomiensis* has, however, four years priority, and though the original description was short—"Espèce tubéreuse, à monticules très-réguliers"—it mentions the two most striking characters of the species.

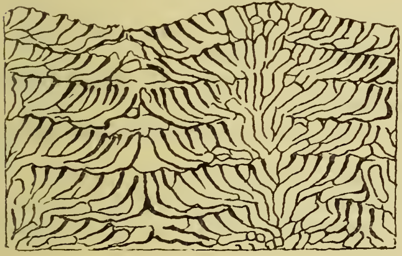

FIG. 74.—*Radiopora neocomiensis*. Vertical section; × 8. **D. 3143.**

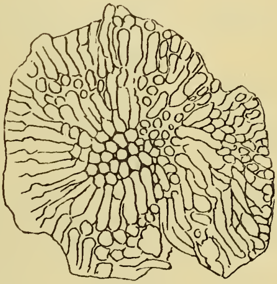

FIG. 75.—*Radiopora neocomiensis*. Horizontal section; × 10. **D. 3143.**

The British Museum Collection includes a specimen which appears to me the same as Römer's *Alveolites heteropora*, and, as shown by Fig. 34, p. 133, the apertures in it are not radial and the zoœcia are not dimorphic. It is a *Reptomulticava*, which differs from *Radiopora*, as the apertures are not radial and the zoœcia monomorphic.

The confused synonymy of this group of species is illustrated by a table on p. 129.

The species is common at Farringdon. Some of the specimens (viz. **D.** $\frac{32}{9}$) from that locality at the Museum of Practical Geology, recorded by Etheridge & Newton as *Ceriopora* (*Multicrescis*) *mammillosa* (Röm.), are young incrusting specimens of *R. neocomiensis.* Another specimen in the same Museum (**D.** $\frac{32}{8}$, also from the Cunnington Coll.), recorded as *C.* (*M.*) *mammillosa*, is a nodular *Heteropora* with a clavate zoarium 21 mm. high and 16 mm. in its greatest diameter; the apertures are non-radial in arrangement, and there is a single series of mesopores between the apertures. There is no evidence to show that the structure is multilamellar, so the specimen is a true *Heteropora*.

One of the specimens in the Museum of Practical Geology (viz. **D.** $\frac{32}{49}$), recorded as *Radiopora heteropora*, belongs to *R. neocomiensis.*

The *Radiopora tuberosa* of d'Orbigny (Prod. Pal. vol. iii. p. 138) is a compound, turbinate *Lichenopora* from the Miocene beds of Turin.

LIST OF SPECIMENS.

D. 3143. A medium-sized zoarium, with five thin sections, three horizontal and two vertical. Lower Greensand. Farringdon. Old Coll. Figs. 74, 75, p. 285.

D. 11,831. A second zoarium, which has the intermediate spaces between the zoœcial pillars of a darker colour than the rest of the zoarium. Lower Greensand. Farringdon. Old Coll.

D. 3142. A zoarium with polished vertical section. Lower Greensand. Farringdon. R. Etheridge Coll.

D. 4984. A small irregularly ovoid zoarium. Lower Greensand. Farringdon. Old Coll.

D. 4985. Three zoaria. Lower Greensand. Farringdon. J. Brown Coll.

D. 4986. A very worn specimen. Lower Greensand. Farringdon. J. Brown Coll.

D. 5040. A zoarium with strongly mammillated surface. Lower Greensand. Farringdon. Cunnington Coll.

D. 7170. Longitudinal ovoid specimen. Lower Greensand. Farringdon. F. Ellis Coll. 1901.

D. 7171. Zoarium. Lower Greensand. Farringdon. F. Ellis Coll. 1901.

10,178. A very worn zoarium. Lower Greensand. Farringdon. Mantell Coll.

10,188. A large irregular zoarium. Lower Greensand. Farringdon. Mantell Coll.

10,189. A small zoarium. Lower Greensand. Farringdon. Mantell Coll.

10,300. A small worn zoarium. Lower Greensand. Farringdon. Mantell Coll.

D. 11,572. A large sub-spherical zoarium. Lower Greensand. Farringdon. Mantell Coll.

10,304. A very worn broken specimen. Lower Greensand. Farringdon. Mantell Coll.

51,158. A zoarium that had been labelled "*Fascicularia aurantium.* Cor. Crag. Ramsholt." Lower Greensand. Farringdon. Old Coll.

3. **Radiopora labyrinthica** (Michelin), 1846.

SYNONYMY.

Ceriopora labyrinthica, Michelin, 1846. Icon. Zooph. p. 208, pl. lii. fig. 11.
Radiopora bulbosa, d'Orbigny, 1851, 1854. Bry. Crét. p. 996, pl. 650, figs. 6–8.
non ,, ,, ? Etheridge & Newton, 1878. Cat. Cret. Foss. Mus. Pract. Geol. p. 7.[1]

DIAGNOSIS.

Zoarium hemispherical, or with a flattened and pitted upper surface. Pits 1–3 mm. dia. The apertures of the zoœcia occur on mæandriform bands across the zoarium, separating the pits which are occupied by the mesopores. The radial arrangement of the series of apertures is in places ill-defined.

DISTRIBUTION.

Cenomanian: Le Mans, Sarthe; Cherck, near Tournay, Belgium.

DIMENSIONS.

	The type-specimen. mm.	60,366. mm.
Height of zoarium	11 ...	10
Diameter of zoarium	22 ...	17 × 19
Diameter of zoœcia	...	·25–·30

AFFINITIES.

In the first volume of this Catalogue it was suggested that the *Ceriopora labyrinthica* of Michelin was a *Cellulipora*, and possibly the same species as *Cellulipora ornata* (Cat. Cret. Bry. Vol. I. pp. 145, 146); and further (p. 147), *Radiopora bulbosa* of d'Orbigny was included as one of the unrepresented species of *Cellulipora*. The latter was the natural interpretation of d'Orbigny's figure (pl. 650, fig. 7). A specimen of the *R. bulbosa* has now been found in the Tesson Collection, and its characters show that the structure is dimorphic and that the apertures of the mature zoœcia are radial in plan. D'Orbigny was therefore quite correct in the generic position he assigned to his species, though the essential generic characters are not shown in his figure.

The British Museum specimen has in places a pitted surface, and it links together Michelin's *C. labyrinthica* and d'Orbigny's

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[1] The specimen on which this record is based (M.P.G., **D.** $\frac{32}{51}a$) is indeterminable without sections.

R. bulbosa. They were both recorded from the same locality, Le Mans; the two chief differences, the hemispherical form of *labyrinthica* contrasted with the cake-shaped form of *bulbosa*, and the more prominent pitting of *labyrinthica*, are probably both only individual differences.

This specimen clearly shows that the *C. labyrinthica* of Michelin is the same as the *Radiopora bulbosa* of d'Orbigny; the zoarium consists of groups of mesopores, around which are bands of apertures of mature zoœcia, and they are in many cases clearly radial in plan.

60,366. A zoarium. The overgrowth of the upper part of the zoarium gives it a laminated appearance. The surface is marked by scattered depressions. Cenomanian—Grès Vert. Le Mans. Tesson Coll.

4. Radiopora tuberculata, d'Orbigny, 1850.

SYNONYMY.

Radiopora tuberculata, d'Orbigny, 1850. Prod. Pal. vol. ii. p. 176.
non ,, ,, Thomas & Peron, 1893. Descr. Invert. foss. terr. crét. sud Tunisie, p. 342, pl. xxx. figs. 7–13.
Domopora ,, d'Orbigny, 1851. Bry. Crét. pl. 648, figs. 1–4.
Semimulticavea tuberculata, d'Orbigny, 1853. *Ibid.* p. 980.
? ,, (*Radiopora*) *tuberculata*, Keeping, 1883. Neoc. Foss. Upware, p. 138.
Lichenopora tuberculata, Pergens, 1890. Rev. p. 383.

DIAGNOSIS.

Zoarium massive and irregular, with large, blunt, irregularly scattered tubercles. Apertures in widely distant radial lines, with from four to six apertures in a line.

DIMENSIONS.

	D'Orbigny's type.	B.M. D. 3159.
	mm.	mm.
Diameter of zoarium ...	21 × 31 ...	17 × 23
Diameter of zoœcial groups	3–5 ...	3–5
Diameter of aperture ...	— ...	·15–·2

FIGURES.

Pl. IV. Fig. 8*a*. The surface of the zoarium; nat. size. Fig. 8*b*, part of the upper surface, where, owing to the tubercular elevations, the radial arrangement of the apertures is somewhat ill-developed; × 8 dia. Cambridge Greensand: Cambridge. **D. 3159.**

DISTRIBUTION.

BRITISH:

Cambridge Greensand: Cambridge.

? Lower Greensand: Upware and Farringdon (*fide* Keeping).

FOREIGN:

Cenomanian: Havre and Cap le Hève, Seine-Inférieure.

AFFINITIES.

The list of genera to which this species has been referred shows the doubts as to its position. D'Orbigny regarded it as intermediate between *Domopora* and *Semimulticavea.* Its large apertures and general characters appear to ally it to the Trepostomata rather than to the Cancellata, and I am inclined therefore to return it to the genus in which d'Orbigny first placed it.

According to my interpretation of the figures by M. Peron of the material referred to this species from the Danian of Chebika, in Southern Tunis, that fossil is not a Bryozoan.

LIST OF SPECIMENS.

BRITISH.

D. 3159. A small zoarium. Cambridge Greensand. Cambridge. Old Coll. Figd. Pl. IV. Fig. 8.

FOREIGN.

D. 4394. Three specimens. Cenomanian—Craie chloritée. Cap de la Hève. Presented by William Hill, Esq., F.G.S.

25,326. A zoarium, 35 × 32 mm. in diameter and 22 mm. thick. The radial lines of apertures are very irregular. Cenomânian. Havre. Ramain Coll.

D. 3715. A zoarium, 21 × 14 mm. in diameter; the sub-colonies are 6 × 5 mm. in diameter and 2–3 mm. thick. Cenomanian. Cap de la Hève. Cunnington Coll.

5. **Radiopora inflata,** Simonowitsch, 1871.

SYNONYMY.

Radiopora inflata, Simonowitsch, 1871. Bry. Essen.: Verh. nat. Ver. preuss. Rheinl. vol. xxviii. p. 38, pl. ii. fig. 1.

DIAGNOSIS.

Zoarium small, clavate, with a broad base and narrow peduncle, or regularly obconic. The sides may be annulated or smooth. Apertures of the zoœcia in groups of four, and the radial arrangement is imperfectly developed.

DISTRIBUTION.

Cenomanian—Grünsand: Essen.

AFFINITIES.

This species is allied to *R. huotiana*, of which it may be a young form, in which the radial arrangement of the large apertures has not been fully developed. The radial grouping is not shown in Simonowitsch's figures, and I therefore felt doubtful from them whether his species was a *Radiopora*; but the arrangement is developed in one of the Museum specimens (**D. 3613**).

LIST OF SPECIMENS.

D. 3627. Three small specimens (in tube). The largest is 9 × 8 mm. in diameter and 9 mm. high; the form is clavate, with a broad base and constriction above it. The second specimen is 5 × 4 mm. in diameter and 8 mm. high; it is regularly obconic, with smooth sides. The third specimen is also obconic, but the sides are annular. Essener Grünsand. Essen. Old Coll.

D. 3613. A zoarium, 6 mm. high and 4 mm. in diameter. The form is clavate, with a flat base and slight peduncle. Mesopores scanty, and the radial lines of apertures are only faintly indicated. Essener Grünsand. Essen. Purchased R. F. Damon, 1877.

6. **Radiopora bosquetiana** (von Hagenow), 1851.

SYNONYMY.

Stellipora bosquetiana, von Hagenow, 1851. Bry. maastr. Kr. p. 45, pl. v. fig. 8.
,, ,, Winkler, 1864. Musée Teyl., Cat. Pal. livr. ii. p. 211.
Domopora ,, d'Orbigny, 1854. Bry. Crét. p. 988.
,, ,, Ubaghs, 1879. Descr. Géol. Pal. Limb. p. 224.
,, ,, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 43.

DIAGNOSIS.

Zoarium beginning as a cylindrical, erect stem, with apertures in vertical series; the zoarium expands upward into a group of several knob-shaped zoœcial groups. In these groups the radial rows of apertures are very numerous, and each row contains about twelve apertures. The centre of each group is convex and not depressed. The groups are separated by broad valleys, occupied by irregularly crowded mesopores.

DISTRIBUTION.

Senonian—Maastrichter Kalk: Maastricht.

Affinities.

Osswald has suggested[1] that this species is a synonym of d'Orbigny's Aptian *Domopora muletiana.*

D. 6449. A small zoarium (on slide). Maastrichter Kalk. Maastricht. Busk Coll. Presented by Miss Busk.

UNREPRESENTED SPECIES.

1. bellula, de Loriol, 1868.

Syn. *Radiopora bellula*, de Loriol, 1868. Mon. Valang. Arzier: Pal. Suisse, ser. 4, pt. ii. p. 65, pl. vi. fig. 2.

Char.—Zoarium massive, turbinate, with a thick peduncle and knob-shaped head. The sub-colonies have raised, mammillated centres, and are separated by bands, often slightly raised, of finer zoœcia. The radial arrangement of the apertures is ill-defined, and the young sub-colonies have a berenicioid aspect.

Distrib.—Valangian: Arzier, Switzerland.

2. huotiana, Michelin, 1846.

Syn. *Ceriopora huotiana*, Michelin, 1846. Icon. Zooph. p. 207, pl. lii. fig. 7.
,, ,, von Hagenow, 1846. In Geinitz, Grundr. Verst. vol. ii. p. 595.
Stellipora ,, von Hagenow, 1851. Bry. maastr. Kr. p. 44.
Radiopora ,, d'Orbigny, 1854. Bry. Crét. p. 995, pl. 650, figs. 1–5.
Lichenopora (*Radiopora*) *huotiana*, *pars*, Pergens, 1890. Rev. p. 383.

Char.—A simple or compound zoarium composed of one or more nodular masses rising from a short stalk. Zoœcial groups opening on all sides of the zoarium. Three to five apertures in each radial row.

Distrib.—Cenomanian: Le Mans and Île Madame, France.

Aff.—M. Pergens includes *R. bulbosa*, d'Orb., as a synonym of this species, but the specimen of *R. bulbosa* in the collection (**60,366**, p. 287) seems to me to show that the two species are distinct. *R. huotiana*, being sometimes sub-clavate, tends, with *Tholopora muletiana* (d'Orb.) (*vide* p. 273), to lessen the division between *Tholopora* and *Radiopora*; the species, however, is clearly a Radioporan, as the groups are not superposed and the stellate groups occur on the sides of the zoarium.

3. ? letourneuxi (Thomas & Peron), 1893.

Syn. *Ceriopora letourneuxi*, Thomas & Peron, 1893. Descr. invert. foss. terr. crét. sud Tunisie, pp. 346–8, pl. xxx. figs. 14–19.

Distrib.—Cenomanian: Tunis.

Aff.—The structure of this species, as shown by Peron's clearest figure (viz. *op. cit.* pl. xxx. fig. 15), is that of a sponge and not of a Bryozoan.

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[1] Osswald, 1890. Bry. Mecklenb. Kr.: Arch. Ver. Mecklenb. vol. xliii. p. 105.

4. **suecica** (Hennig), 1894.

Syn. *Lichenopora suecica*, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. pp. 35–6, pl. ii. figs. 33–6, and fig. 20, p. 35.
? *Ceriopora stellifera*, Schlüter, 1870. Geogn. Pal. Reise südl. Schweden: N. Jahrb. 1870, p. 939.

Char.—Zoarium irregularly hemispherical, about 30–80 mm. in diameter and 20 mm. thick. Sub-colonies irregular in shape and 3–4 mm. in diameter, widely separated. Radial apertures usually five or six in one series. Apertures ·11 mm. in diameter.

Distrib.—Senonian—Campanian—Zone of *Belemnitella mucronata* (beds with *Actinocamax mamillatus*): Balsberg, Gropemöllan, and Ö. Karup, Sweden.

RADIOCAVARIA, Hamm, 1881.

[Bry. mastr. Ob.-Sen. i., Cycl. p. 42.]

Diagnosis.

Radioporidæ with zoarium arborescent; dichotomously branched. The axes of the stems are hollowed and divided across by tabulæ, as in *Cavaria*.

Zoœcia in stellate groups.

Type Species.

Radiocavaria fallax, Hamm. Maastrichtian: Maastricht.

Affinities.

This Bryozoan, by its stellate groups of zoœcia, agrees with *Multicavea* and *Semimulticavea*; but, as Hamm describes the zoœcia as being tabulate and dimorphic, it is probably an ally of *Radiopora*. It may be regarded as a Radioporoid with an arborescent zoarium.

UNREPRESENTED SPECIES.

fallax, Hamm, 1881.

Syn. *Radiocavaria fallax*, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 42.

Char.—Zoarium of thick cylindrical stems, dichotomously branched; the aspect is like *Heteropora*. Zoœcial groups but slightly regular, round or elongate. The middle area of the groups is either depressed or raised. Zoœcia small, thickly crowded. The larger apertures are about twice the diameter of the smaller; they are widely spaced in radial series, containing about three, surrounded by a slightly raised rim, and raised into short ridges on the edge of the middle area.

Distrib.—Senonian—Maastrichtian: Maastricht.

Sub-class PHYLACTOLÆMATA, Allman.

Family PLUMATELLIDÆ.

DIAGNOSIS.

Phylactolæmata with a rooted zoarium.

PLUMATELLITES, Frič, 1901.

proliferus, Frič.

SYN. *Plumatellites proliferus*, Frič, 1901. Perucer Sch.: Arch. naturw. Landesf. Böhm. vol. xi. No. ii. pp. 178, 179.

DISTRIB.—Perucer Schichten (Cenomanian): Kounic, Bohemia.

The Bryozoa of the sub-class Phylactolæmata, being soft-bodied, can only rarely be expected as fossils; but Dr. Frič has identified an incrusting organism on a *Unio* from the fresh-water Cenomanian beds of Bohemia as a fossil *Plumatella.* The organism is branched, and is 8 mm. long with branches from ·6 to 1 mm. wide. The fossil certainly resembles a *Plumatella,* though the structure is too imperfectly preserved for the identification to be certain; but the specimen is of interest as the only fossil representative of the Phylactolæmata.

ADDENDA ET CORRIGENDA.

CYCLOSTOMATA TUBULATA.

DIASTOPORIDÆ.

PROBOSCINA, Audouin, 1826.

Vol. I. pp. 21, 29. To Synonyms of *Proboscina* (p. 21) add:

Leptopora, d'Orbigny, 1849. Genres nouv. Moll. bryoz.: Rev. Mag. Zool. ser. 2, vol. i. p. 504.

Leptopora elegans to be added to the Synonymy of *Proboscina fasciculata* (p. 29).

DIASTOPORA, Lamouroux, 1821.

Vol. I. p. 139. Add to *Diastopora*, Unrepresented Species:

19. composita (Hennig), 1894.

Syn. *Mesenteripora composita*, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. pp. 5–6, pl. i. figs. 14–17; fig. 2, p. 5, and fig. 3, p. 6.

Char.—Zoarium rounded; composed of sheets arranged in concentric groups. The sheets are bilaminar. Peristomes long and well raised, and widely spread over the sides of the sheets, but crowded at the margin. Apertures round, somewhat constricted.

Distrib.—Senonian—Campanian—Zone of *Belemnitella mucronata* (beds with *Actinocamax mamillatus*): Balsberg.

IDMONIIDÆ.

IDMONEA, Lamouroux, 1821.

Vol. I. p. 150. To Synonyms of *Idmonea hagenowi* (Sharpe) add:

Actinopora (*Radiopora*) *elegans*, Etheridge & Newton, 1878. Cat. Cret. Foss. Mus. Pract. Geol. p. 6.

Vol. I. p. 155. To Unrepresented Species of *Idmonea* add:

4. radiata (Hennig), 1894.

Syn. *Semiclausa radiata*, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 8, pl. i. figs. 2, 3.

,, ,, Hennig, 1894. Om Åhussandstenen: Geol. För. Stockh. Forh. vol. xvi. p. 510.

Char.—Zoarium with radial dichotomous ridges, the upper surface of which is rounded. Rows of apertures usually opposite, about three in a row on each slope. Fifteen rows of apertures in 3 mm. Apertures ·08 mm. in diameter.

Distrib.—Senonian—Campanian—Åhussandsten: Åhus, Sweden.

Aff.—This species is a near ally of *I. triangularis* (Hennig), from which it differs by its rounded and dichotomous ridges. In the former respect it agrees with *I. hagenowi* (Sharpe). This species was referred by Hennig to *Semiclausa*, but he describes the zoarium of that genus as the same as in *Reptoclausa*; but the only difference between those genera is zoarial; hence Hennig's *Semiclausa* and his *Reptoclausa* are the same.

5. **triangularis** (Hennig), 1894.

Syn. *Reptoclausa*	*triangularis*,	Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 8, pl. i. fig. 1.
non Idmonea	,,	Pergens, 1890. Rev. p. 348 (and other memoirs, for which see Cat. Vol. I. p. 163).

Char.—Zoarium with short triangular ridges, many of which are short and detached. Apertures in rows of from two to four on each slope of the ridge. Rows alternate; about twelve rows in each length of 3 mm. Apertures ·08 mm. in diameter.

Distrib.—Senonian—Campanian: Zone of *Belemnitella mucronata*, Köpinge; beds with *Actinocamax mamillatus*, Gropemöllan and Ö. Karup, Sweden.

Aff.—The nearest ally of this species is *I. hagenowi* (Sharpe), from the Farringdon Sponge Gravels; from that species it differs by its triangular carinate ridges and the smaller diameter of its apertures.

RETECRISINA, Gregory, 1899.

To Unrepresented Species on p. 186 add:

2. **meudonensis** (d'Orbigny), 1851.

Syn. *Bidiastopora*	*meudonensis*,	d'Orbigny, 1851. Bry. Crét. pl. 627, figs. 22–5.
Fasciporina	,,	d'Orbigny, 1853. *Ibid.* p. 694.
Fascipora	,,	Pergens, 1890. Rev. p. 377.
,,	,,	Canu, 1900. Géol. Romorantin: Bull. Soc. géol. France, ser. 3, vol. xxviii. p. 103.

Char.—Zoarium of flat, laterally compressed branches, with crowded apertures on the front edge, and the apertures on the sides in curved linear series, in which the apertures are distant on the hinder part and become crowded near the front edge.

Distrib.—Senonian—Maastrichtian: Meudon, near Paris.
Santonian: Romorantin, Loir-et-Cher.

AFF.—The curved lateral lines of apertures resemble *Retecrisina*. At first it appears to differ from that genus by the crowded apertures on the front edge of the frond, but that arrangement is indicated in some zoaria of *Retecrisina*; and this Bryozoan so closely resembles in structure the specimen of *R. papyracea* (d'Orb.) shown in this Catalogue, Vol. I. Pl. IX. Fig. 1*b*, that it may be included as a *Retecrisina*. The species differs from the Theonoids by having apertures scattered over the whole lateral surface of the fronds.

3. **recta** (Hennig), 1894.

SYN. *Reticulipora recta*, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 15, pl. i. figs. 11–13.

CHAR.—Zoarium of regular network, with thin branches; the interspaces are quadrangular to hexagonal. Apertures in rows containing from five to eleven; eleven rows in a width of 3 mm. Apertures ·06 mm. in diameter.

DISTRIB.—Senonian—Campanian: Balsberg.

AFF.—Allied to *R. ligeriensis* (d'Orb.), but with larger interspaces and more apertures in the vertical rows. *R. obliqua* (d'Orb.) has a less regular meshwork.

RETECAVA, d'Orbigny, 1854.

Vol. I. p. 187:

Spiridmonea, Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 12.

This genus appears to me a synonym of *Retecava*; but I only know it by Hennig's description and two figures, which do not show anything generically distinct from *Retecava*. The translation of his diagnosis is as follows:—

"Stem free, with a spiral twist, owing to the small, spirally arranged, laterally compressed branches; the zoœcial apertures occur on the upper sides of the branches, and have the arrangement characteristic of *Idmonea*, viz. the apertures are in transverse rows on each side of the middle line of the branches. The under sides of the branches, as well as the whole upper surfaces, are furnished with fine (refflor) 'reinforcement canals,' and here and there with the pores that serve as the mouths of these canals."

Hennig's type species of his *Spiridmonea* is *S. lundgreni*, *op. cit.* pp. 12, 13, pl. i. figs. 9, 10, from the Campanian of Balsberg. Its nearest ally among species of *Retecava* is *R. lichenoides* (Goldf.), which amongst other localities occurs in the Campanian of Rügen.

Vol. I. p. 216, add:

CLAVICLAVA, d'Orbigny, 1854.

[Bry. Crét. p. 1028.]

DIAGNOSIS.

Idmoniidæ with spatulate erect zoarium, with the apertures confined to one face of the expanded end of the zoarium. The apertures are flush with the surface of the zoarium, and are arranged in ill-defined transverse lines.

TYPE SPECIES.

C. compressa, d'Orbigny, 1854. Neocomian: France.

AFFINITIES.

This genus was included by d'Orbigny among the Cavidæ as a close ally of *Ceriopora*. It was placed by M. Pergens in his Cerioporidæ, with the same affinities. But the information given by d'Orbigny does not indicate any particular resemblance to the *Ceriopora* group, for the zoarium is a flat layer and not massive; and it has apparently simple zoœcia with no indication of either cancelli or mesopores. The limitation of apertures to the obverse face of the zoarium, and the suggestion given by d'Orbigny's figure of their occurrence in transverse rows, both support the affinity of this genus to the Idmoniidæ, of which it is a primitive but somewhat aberrant form.

compressa, d'Orbigny, 1854.

Claviclava compressa, d'Orbigny, 1854. Bry. Crét. p. 1028, pl. 790, figs. 10–13.
,, ,, Pergens, 1890. Rev. p. 387.

DISTRIB.—Neocomian: Fontenoy, Yonne.

CEIDMONEA, Pergens, 1893.

The genus *Ceidmonea*, Pergens, of which the type species is *C. macgillivrayi*, Pergens, is founded on a worn branch, of which the only certain character is that the zoœcia opened on one face only. The type-specimen, judging by M. Pergens' excellent figure, is so imperfect and worn that both genus and species appear to me useless.

Pergens, Nouv. Bry. Crét. Limb.: Bull. Soc. belge Géol. vol. vii. 1893, Mém. p. 179, pl. ix. fig. 3 (*non* 4 as in text).

ENTALOPHORIDÆ.

ENTALOPHORA, Lamouroux, 1821.

Vol. I. p. 256, add to *Entalophora*:

34. francqana (d'Orbigny), 1853.

Syn. *Fasciporina francqana*, d'Orbigny, 1853. Bry. Crét. p. 695, pl. 745, figs. 1–3.
Fascipora ,, Pergens, 1890. Rev. p. 377.

Char.—Zoarium cupuliform; short stem expanding to a funnel-shaped head; the upper surface is hollow. Apertures in a crowded series along the edge of the funnel. Zoarium covered on both inner and outer surfaces by simple tubular zoœcia.

Distrib.—Senonian: Meudon, near Paris.

Aff.—The form of the zoarium agrees with that of *Clypeina*, but this species differs by the zoœcia covering both surfaces. The character of the zoœcia, as shown in d'Orbigny's figures, are those of the ordinary Tubulata, such as *Diastopora* or *Entalophora*. Crowded apertures occur on the edges of some species of *Diastopora*, and this species may be only a *Discosparsa*, in which the zoœcia have their apertures on both sides of the zoarium. The zoarium is not unlike that of the specimen of *Entalophora anomalissima*, Nov., figured by Novak (Bryoz. böhm. Kreidef.: Denk. Akad. Wiss. Wien, vol. xxxvii. pt. ii. pl. vii. figs. 22*a*, *b*, and 23), and may be only an *Entalophora* with a flattened expansion on the end of the branch and the apertures crowded on the margin.

CLYPEINA, Michelin, 1844.

Vol. I. p. 280, add Unrepresented Species:

1. costata (Marsson), 1887.

Syn. *Discosparsa costata*, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv. pt. i. p. 44, pl. iv. fig. 5.

Char.—Zoarium short, height being about half the diameter. Apertures in a single row round the upper edge. The sides are vertically fluted. A few scattered apertures on the upper surface, which is concave.

Distrib.—Maastrichtian: Rügen.

Aff.—Marsson says it is allied to *D. radiata*, d'Orb. (pl. 743, figs. 8–11, especially to fig. 10), in which species, however, the apertures cover the whole of the convex upper surface, instead of occurring on the rim of the funnel-shaped zoarium.

2. rosula, von Hagenow, 1839.

Syn. *Ceriopora rosula*, von Hagenow, 1839. Mon. Rüg.: N. Jahrb. 1839, p. 286, pl. v. figs. 8*a–d*.
,, ,, von Hagenow. In Geinitz, Grundr. Verst. p. 595.
Discosparsa ,, Marsson, 1887. Bry. Rüg.: Pal. Abh. vol. iv. pt. i. p. 45, pl. iv. fig. 6.
,, ,, Stolley, 1892. Kreide Schleswig-Holsteins: Mitt. min. Inst. Kiel, vol. i. p. 245.

Char.—Zoarium circular, about 2·4 mm. in diameter and 1·5 mm. high. It has a short blunt stem. The upper surface is concave, and is covered with the oblique or crescentic apertures of the zoœcia. The normal apertures are on a vertical edge, ·5 mm. in thickness, on the rim of the zoarium. The apertures there are small, crowded, and multiserial; there are about four to five apertures in the height of the rim.

Distrib. — Senonian — Campanian: Rügen. Mukronaten-Kreide: Lägerdorf, Schleswig-Holstein (*fide* Stolley).

Aff.—It differs from the typical forms of *Clypeina* by the apertures along the rim being multiserial, and the apertures being distributed over the whole upper surface; in its nearest ally, *C. costata*, the apertures on the upper surface are fewer and more widely spaced.

After Vol. I. p. 284:

HAPLOŒCIA, Gregory, 1896.

Revision Brit. Jur. Bry. pt. v.: Ann. Mag. Nat. Hist. ser. 6, vol. xvii. p. 199; B.M. Cat. Jur. Bry. p. 157.

Diagnosis.

Entalophoridæ in which the distal ends of the zoœcia are angular and usually hexagonal. Peristomes never greatly raised. Apertures small. The zoœcia are arranged in transverse linear series or quincuncially.

Type Species.

Haploœcia straminea (Phillips), 1829. Bathonian. *Millepora* bed, Yorkshire Coast, near Scarborough, and ranging from the Cornbrash to the Bajocian.

Affinities.

This genus has been discovered in the Cretaceous by M. Filliozat, who places it among the Eleidæ; and that it is intermediate between the Entalophorids and Eleids appears most probable. M. Filliozat describes it as operculate, but the evidence in favour of this view appears to me inadequate, and the genus is therefore here left with the Entalophoridæ.

Haploœcia annulata, Filliozat, 1908.

Syn. *Haploœcia annulata*, Filliozat, 1908. Bry. crét. Vendôme: Bull. Soc. géol. France, ser. 4, vol. vii. p. 396, pl. xiii. fig. 7.

Char.—Zoarium with branches up to 2 mm. in diameter. Apertures in horizontal linear series. Apertures ·14 mm. in diameter.

Distrib.—Turonian—Angoumian: Zone of *Catopygus ebrayi*, Bessé, Sarthe; Zone of *Terebratulina bourgeoisi*, Trôo and Lavardin, Loir-et-Cher.

D. 4923. A stem (on slide). Turonian—Craie marneuse. Villardin (? Lavardin). Purchased F. H. Butler, 1897.

UNREPRESENTED SPECIES.

1. **canui,** Filliozat, 1908.

Syn. *Haploœcia canui*, Filliozat, 1908. *Ibid.* p. 396, pl. xiii. figs. 4–6.

Char.—Zoarium with branches from ·08 to 1 mm. in diameter. Apertures in transverse linear series; shape regular. Apertures ·11 to ·12 mm. in diameter. The zoœcial structure appears to be a gonocyst (Filliozat, *op. cit.* pl. xiii. fig. 8).

Distrib.—Senonian—Coniacian—Zone of *Crania ignabergensis*: Vendôme, Loir-et-Cher.

ELEIDÆ.

SEMIMULTELEA, d'Orbigny, 1853.

To Vol. I. p. 298:

3. **Semimultelea dixoni,** Lang, 1906.

Synonymy.

Semimultelea dixoni, Lang, 1906. Reptant Eleid., Geol. Mag. dec. 5, vol. iii. p. 64; fig. 4, p. 62; fig. 12, p. 64.

Diagnosis.

Zoarium of 2–3 layers. No avicularia. Apertures very large, being ·33 mm. in diameter; they are sub-triangular to sub-circular, and irregularly distributed. Rim of the apertures thin. Closed zoœcia numerous.

Distribution.

Middle Chalk—Zone of *Micraster cortestudinarium*: Kenley, Surrey.

D. 7845. The type-specimen. Middle Chalk—zone of *Micraster cortestudinarium*. Opposite the "Rose and Crown" Inn (pit No. 32 of Dibley and No. 113 of Young), Kenley, south of Croydon, Surrey. Collected and presented by Messrs. C. P. Chatwin and T. H. Withers, 1905.

ELEA, d'Orbigny, 1853.

To Vol. I. p. 303:

3. **Elea meridiana,** Lang, 1906.

Synonymy.

Elea meridiana, Lang, 1906. In Woods, Cret. Fauna Pondoland: Ann. S. Afric. Mus. vol. iv. pt. vii. p. 283, pl. xxxiii. figs. 10–12.

Diagnosis.

Zoarium bilaminar. Zoœcia with subcircular apertures; ·15 mm. in transverse diameter, which is slightly longer than the distal-proximal diameter. The zoœcia expand suddenly in width beneath the apertures. The closed zoœcia are sporadic in distribution, and are usually closed by a perforated dome-shaped cap. Gonocysts as large, tumid areas, formed of several zoœcia, and having two or more apertures.

Distribution.

Senonian—Campanian: Pondoland, South Africa.

D. 11,834. Three fragments of the type-specimen. Upper Cretaceous: Pondoland, South Africa. Presented by the Geological Survey of Cape Colony, 1909.

ELEIDÆ (?).

To Vol. I. after p. 357:

PENNIPORA, Hamm, 1881.

[Bry. mastr. Ob.-Sen. i., Cycl. p. 37.]

Diagnosis.

Eleidæ (?) in which the zoarium consists of an erect, branched stem. The stem consists of a cylindrical series of long thin zoœcia, which form a central tube; surrounded by a layer of zoœcia composed of the expanded distal ends of the zoœcia. In the middle part of the stem the zoœcia are irregularly arranged. The apertures are subequal.

Type Species.

Pennipora beyrichii, Hamm. Maastrichtian: Maastricht.

Affinities.

This genus is placed by Hamm in his group the Cerioporina, but he compares the arrangement of the zoœcia to that in his Stigmatoporina. In his memoir the genus is placed shortly after *Heteropora*, to which it has a resemblance in that the apertures are unequal in size. But in the description of the only species Hamm states that the apertures are only slightly unequal in size. The structure of the zoarium resembles that in *Inversaria*, and, so far as can be judged from Hamm's description, the Bryozoan is probably an ally or synonym of *Inversaria tubiporacea* (Goldf.).[1]

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[1] See the figures given in the first volume of this Catalogue, pp. 351–2.

UNREPRESENTED SPECIES.

beyrichii, Hamm, 1881.

Pennipora beyrichii, Hamm, 1881. Bry. mastr. Ob.-Sen. i., Cycl. p. 37.

Char.—Zoarium very large and thick, with short branches, and the aspect of a Cerioporoid composed of many layers of zoœcia. Apertures crowded, subequal; in places they are arranged in groups.

Distrib.—Maastrichtian: Maastricht.

CYCLOSTOMATA CANCELLATA.

HORNERIDÆ.

HORNERA, Lamouroux, 1821.

Vol. I. p. 367. To Unrepresented Species add:

6. sparsipora, Hennig, 1894.

Syn. *Hornera sparsipora,* Hennig, 1894. Bry. Sver. Krit. ii., Cycl.: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. pp. 13–15, pl. i. figs. 7, 8; figs. 5, 6, p. 14.

Char.—Zoarium of crowded thick branches, with many of the apertures in transverse rows of about four apertures in a row; the rows are usually opposite. In parts of the stems the apertures are described as irregularly arranged. Pores on the reverse face small and sparsely scattered.

Distrib.—Senonian—Campanian: Balsberg.

Aff.—This species is most allied among described Cretaceous species to von Hagenow's *H. langethali* from Rügen; but von Hagenow named two Senonian species of *Hornera* from Sweden *H. compressa* and *H. trigonopora* (Bry. maastr. Kr. p. 25), and may have founded one of those on this species. *H. sparsipora* resembles Eocene rather than Cretaceous species.

PETALOPORIDÆ.

PETALOPORA, Lonsdale, 1850.

Vol. I., after p. 382:

4. Petalopora consimilis (Ulrich),[1] 1882.

Synonymy.

Heteropora consimilis, Ulrich, 1882. Amer. Palæoz. Bry.: Journ. Cincinnati Soc. Nat. Hist. vol. v. p. 145, pl. vi. fig. 11.

Char.—Zoarium of narrow branches (2½–3 mm. in diameter). Apertures large and surrounded by a ring of maculæ.

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[1] It is probable that Ulrich's other species, *Heteropora attenuata,* also from Pulaski County (*ibid.* p. 144, pl. vi. fig. 12), is also a *Petalopora*, but the original figure rather resembles a *Sparsicavea.*

DISTRIBUTION.

Upper Cretaceous: Pulaski County, Arkansas.

D. 5297. Three broken branches, 2·5–3 mm. in diameter; the largest is 10 mm. long. Upper Cretaceous. Pulaski County, Arkansas. Ulrich Coll.

5. Petalopora parvicella (Gabb & Horn), 1860.

SYNONYMY.

Multicrescis parvicella, Gabb & Horn, 1860. Cret. Cor. N. Jers.: Proc. Acad. Nat. Sci. Phil. p. 367.

,, ,, Gabb, 1860. New Amer. Tert. Cret. Foss.: Journ. Acad. Nat. Sci. Phil. ser. 2, vol. iv. p. 401, pl. 69, figs. 36–8.

,, ,, Gabb & Horn, 1862. Mon. foss. Polyz.: *ibid.* vol. v. p. 178, fig. 70.

,, ,, Johnson, 1905. Annot. List: Proc. Acad. Nat. Sci. Phil. vol. lvii. p. 5.

DIAGNOSIS.

Zoarium of narrow, cylindrical, dichotomous branches. Apertures raised and widely spaced; numerous small maculæ scattered over the wide, smooth areas between the apertures.

DISTRIBUTION.

Senonian—Maastrichtian: Vincentown, New Jersey.

AFFINITIES.

This species is represented in the Museum Collection by four small fragments (**D. 5298**), which are about 1·5 mm. in diameter. The species is a *Petalopora.*

D. 5298. Four fragments of branches. Upper Cretaceous. Vincentown, New Jersey. Ulrich Coll.

Vol. I. p. 383. Add to *Petalopora striato-punctata* (Hag.):

SYN. ? *Eschara biserialis*, von Reuss, 1854. Kreidesch. Ostalp.: Denk. Akad. Wiss. Wien, vol. vii. p. 136, pl. xxxvii. fig. 8.

DISTRIB. — Coniacian — Rudisten Mergel: Nefgraben, near Gosau, Upper Austria.

This species, to which my attention has been called by Mr. Lang, was well described and figured by von Reuss. It belongs to the series of *P. costata*, but differs therefrom by the greater regularity of its apertures, which occur in a regular spiral. As in *P. costata*, the maculæ are usually biserial, with occasional additional maculæ. It agrees with *P. striato-punctata* by its flattened branches and conspicuous longitudinal ribbing, but the information regarding that species, given by its founder, is inadequate for the certain identification of the two species.

SPARSICAVEA, d'Orbigny, 1853.

Sparsicavea dichotoma (Goldf.).

Vol. I. pp. 393–4, add to Synonymy:

Multicrescis laxata, d'Orbigny, 1854. Bry. Crét. p. 1077, pl. 800, figs. 10, 11.
Heteropora dichotoma, Pergens, 1890. Rev. p. 373.

And to localities:

Sainte-Colombe, Manche.

Vol. I. p. 397:

5. marssoni, nov. nom. To Synonyms add:

Ceriopora dichotoma (*non* Goldfuss), von Hagenow, 1839. Mon. Rüg.: N. Jahrb. 1839, p. 282, pl. v. fig. 4.
Pustulopora heteropora, Römer, 1840. Verst. nordd. Kr. p. 22.
Heteropora pustulosa, von Hagenow, 1850. In Geinitz, Quadersandsteingeb. p. 242.
,, ,, Boll, 1852. Geogn. Mekl.: Arch. Ver. Naturg. Mekl. vol. vi. p. 64.
,, ,, Kade, 1852. Los. Verst. Schanzenb. p. 20.

When renaming Marsson's species I did not recognize its probable identity with that which had been figured by von Hagenow in 1839 as *Ceriopora dichotoma*. The name proposed in 1899, however, stands, as all the specific names given to this species, viz., *dichotoma*, Hag., *heteropora*, Röm., *pustulosa*, Hag., and *irregularis*, Mars., are preoccupied by species of *Sparsicavea*.

Add to Vol. I. p. 403:

CHORISTOPETALUM, Lonsdale, 1849.

[Notes on Foss. Zooph.: Quart. Journ. Geol. Soc. vol. v. p. 69.]

DIAGNOSIS.

Petaloporidæ erect, with the maculæ few in number and irregularly distributed. Surface smooth, with lowly raised peristomes.

The zoarium is dendroid, and consists of an axial bundle of long zoœcia, surrounded externally, at least in the older parts of the zoarium, by a multilamellar layer; the zoœcia at their distal ends bend nearly at right angles, and some of them are continued to the surface through the multilamellar layer as long sinuous tubes.

TYPE SPECIES.

Choristopetalum impar, Lonsdale. Quart. Journ. Geol. Soc. vol. v. p. 69, pl. iv. figs. 5–11. Lower Greensand: Atherfield, Isle of Wight.

AFFINITIES.

This interesting genus has been almost completely overlooked in the literature of Bryozoa. It was omitted from the first volume of this Catalogue in the hope that further material might be available, and would reconcile the apparently conflicting evidence of some of the specimens assigned to *Choristopetalum*. The general resemblance of the fossil is to the Petaloporidæ, but parts of the zoarium free of the multilamellar layer suggested that it might be one of the Trepostomata.

A specimen (**D. 3147**) had been assigned to *Choristopetalum* and figured on Pl. V. Fig. 10; but from the evidence of that specimen alone, the fossil would be regarded as a dendroid *Ceriopora*. The zoœcia are not quite uniform in size, but the small ones resemble acanthopores rather than mesopores, and are probably only young zoœcia. The zoœcia, therefore, may be regarded as monomorphic. Fortunately, Lonsdale's type-specimen is available for reference in the Museum Collection, and confirms the general accuracy of his elaborate series of illustrations. His fig. 6*, showing the vertical tubes with diaphragms, would be consistent with a species either of Trepostomata or Cyclostomata. The structures illustrated by the other figures (e.g. No. 6) show that the affinities of the genus are with *Sparsicavea*, from which it is distinguished by the multilamellar covering of the axial bundle of zoœcia.

Choristopetalum impar, Lonsdale, 1849.

SYNONYMY.

Heteropora sp., Fitton, 1847. Section from Atherfield to Rocken End: Quart. Journ. Geol. Soc. vol. iii. p. 296.

Choristopetalum impar, Lonsdale, 1849. Notes on Foss. Zooph.: *ibid.* vol. v. pp. 69–77, pl. iv. figs. 5–11.

,, ,, Edwards & Haime, 1850. Brit. Foss. Corals, p. 70.

,, ,, Lonsdale, 1851. Memorandum resp. *C. impar*: Quart. Journ. Geol. Soc. vol. vii. pp. 113–14.

,, ,, Morris, 1854. Cat. Brit. Foss. 2nd ed., p. 49.

,, ,, Bristow, 1889. Geol. Isle of Wight, 2nd ed., p. 262.

,, ,, Newton & Etheridge, 1878. Cat. Cret. Foss. Mus. Pract. Geol. pp. 49, 50.

DIAGNOSIS.

Zoarium of thick dichotomous branches, varying from 5 to 8 mm. in diameter, in branches nearly 40 mm. long. Each branch consists of an axial group of longitudinal zoœcia, surrounded by multilamellar tissue. The axial group is usually from 2 to 3 mm. in diameter. Most of the multilamellar zone is considerably thicker than the axial bundle, and is traversed by prolongations of the axial zooecia as long sinuous tubes. The surface of the zoarium is covered by irregularly distributed apertures, each surrounded by a slightly raised peristome. The maculæ are irregularly arranged, and one line of them occurs between adjacent apertures.

DISTRIBUTION.

Lower Greensand (Aptian): Shanklin, Isle of Wight.
Upper Perna Bed (base of Atherfield Clay): Atherfield, Isle of Wight.

FIGURES.

Pl. V. Fig. 10*a*, a zoarium from the side; nat. size. Fig. 10*b*, part of the surface of the same specimen; × 9 dia. Fig. 10*c*, a thin transverse section from the same; × 8 dia. Lower Greensand (Aptian): Shanklin, Isle of Wight. M. Norman Coll., D. 3141.

AFFINITIES.

This species is the type of the genus. It was originally referred to *Heteropora* owing to its apparently dimorphic character. It was described in great detail by Lonsdale in 1849, and though he considered its affinities to *Heteropora*, he concluded that it was one of the Anthozoa and not a Bryozoan. Milne-Edwards & Haime in 1850 repudiated it as a coral, but Lonsdale rediscussed the matter in 1851 and stoutly maintained his previous conclusion. There can be no doubt, however, that Edwards & Haime were right.

The main difficulty in dealing with the species is to determine whether such a form as **D. 3147**, shown on Pl. V. Figs 10*a*, *b*, is simply the central axis of *Choristopetalum*, or whether it belongs to a distinct genus. I have come, however, to the hesitating conclusion that the specimen thus figured is the central part of a *Choristopetalum*.

LIST OF SPECIMENS.

46,801. The type-specimen and sections. Lower Greensand. Atherfield. Figd. Quart. Journ. Geol. Soc. vol. v. pl. iv. figs. 5–11.

D. 3146. Three fragments and two thin sections of stem. Lower Greensand. Shanklin. Norman Coll.

? D. 3147. Part of a zoarium without the external multilamellar layers. Lower Greensand. Shanklin. Figd. Pl. V. Fig. 10.

DACTYLETHRATA.

CLAUSIDÆ.

CLAUSA, d'Orbigny, 1853.

Vol. I. p. 425 :

Hennig (Bry. Sver. Krit. ii., Cycl. : Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii. p. 24) records from the Campanian of Sweden at Qvarnby the *Heteropora subreticulata*, von Reuss, founded (Denk. Akad. Wiss. Wien, vol. xxix. 1869, p. 288, pl. xxxvi. fig. 7) on a specimen from the Oligocene of the Val di Lonte. This species is probably a *Clausa*.

REPTOMULTICLAUSA, d'Orbigny.

The following Unrepresented Species was omitted from Vol. I. pp. 425–6 :—

4. orbignyana, de Loriol, 1861.

Syn. *Reptomulticlausa orbignyana*, de Loriol, 1861. Invert. foss. Néoc. Mont Salève, p. 139, pl. xvii. fig. 6.

Char.—Zoarium large and thick. Apertures of the zoœcia widely separated and irregularly scattered. The dactylethræ in single series around each aperture and only seen after the surface is worn. The surface of the zoarium is smooth and punctulate. Peristomes low.

Distrib.—Neocomian : La Varappe, Mont Salève, Switzerland.

Aff.—This species was founded on a single specimen, and was overlooked during the preparation of Vol. I. of this Catalogue. The name of d'Orbigny was unfortunately used for another species, which is the type of the genus. Hence that species, the *Reptomulticlausa papularia* of d'Orbigny, has again to be renamed, and may be called *Reptomulticlausa typica*.

The *Acerviclausa* of Gabb & Horn, founded on a species *A. vermicularis*,[1] Gabb & Horn, from Mullica Hill, New Jersey, is possibly a synonym of *Reptomulticlausa* ; but neither the figures nor descriptions are sufficiently precise to show the family to which this Bryozoan belongs. The genus is not mentioned in Weller's recent monograph of the New Jersey Cretaceous fossils.

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[1] W. M. Gabb. New Amer. Tert. and Cret. Foss. : Journ. Acad. Nat. Sci. Phil. new ser. vol. iv. pt. iv. 1860, p. 403, pl. lxix. figs. 42–4.

The following Swedish records are to be added to Vol. I of this Catalogue from the second part of Hennig's monograph (A. Hennig, 1894. Bry. Sver. Kritsystem, pt. ii., Cyclostomata: Lunds Univ. Årsskrift, vol. xxx., Acta Physiogr. No. viii.):—

p. 5. To Synonymy of *Stomatopora granulata* (M. Edw.) add *Stomatopora linearis*, Hennig, *op. cit.* p. 4. To Distrib. add Senonian—Campanian—Zone of *Belemnitella mucronata* (beds with *Actinocamax mamillatus*): Balsberg.

p. 14. To Synonymy of *Stomatopora gracilis* (M. Edw.) add *Stomatopora longiscata*, d'Orb., Hennig, *op. cit.* p. 3. To Distrib. add Zone of *Belemnitella mucronata* (beds with *Actinocamax mamillatus*): Balsberg.

p. 48. To Synonymy of *Proboscina radiolitorum* (d'Orb.) add *Reptotubigera ramosa*, d'Orb., Hennig, *op. cit.* p. 7. To Distrib. add Danian: Annetorp. Campanian: Köpinge, Balsberg, and Ifö.

p. 70. To Synonymy of *Hornera tubulifera* (Hag.) add *Hornera tubulifera*, Hag., Hennig, *op. cit.* p. 13. To Distrib. add Danian: Annetorp.

p. 102. To Synonymy of *Diastopora compressa* (Goldf.) add *Mesenteripora compressa*, Goldf., Hennig, *op. cit.* p. 5. To Distrib. add Campanian: Balsberg.

p. 137. To Synonymy of *Diastopora pustulosa* (Hag.) add *Cavaria pustulosa*, Hag., Hennig, *op. cit.* p. 4, fig. 1. To Distrib. add Campanian: Balsberg and Karlshamn.

p. 166. To Synonymy of *Idmonea angulosa* (d'Orb.) add *Idmonea angulosa*, d'Orb., Hennig, *op. cit.* p. 9. To Distrib. add Danian: Annetorp.

pp. 171–2. To Synonymy of *Crisina* (*Tervia*) *dorsata* (Hag.) add *Idmonea dorsata*, Hag., Hennig, *op. cit.* p. 9, and var. *faxeensis*. To Distrib. add Campanian: Ignaberga, Balsberg, Barnakällegrottan, and Karlshamn; and for var. *faxeensis*, Danian: Annetorp.

p. 190. To Synonymy of *Retecava cretacea* (M. Edw.) add *Idmonea macropora*, Mars., Hennig, *op. cit.* p. 11, and *Idmonea communis*, d'Orb., Hennig, *op. cit.* p. 12. To Distrib. add Campanian: Qvarnby and Karlshamn.

p. 199. To Synonymy of *Retecava pseudodisticha* (Hag.) add *Idmonea pseudodisticha*, Hag., Hennig, *op. cit.* p. 11. To Distrib. add Campanian: Qvarnby, Balsberg, Ignaberga, etc.

p. 202. To Synonymy of *Retecava cancellata* (Goldf.) add *Idmonea cancellata*, Goldf., Hennig, *op. cit.* p. 10, pl. i. figs. 4–6. To Distrib. add Danian: Annetorp.

p. 203. To Synonymy of *Retecava geometrica* (Hag.) add *Idmonea geometrica*, Hag., Hennig, *op. cit.* p. 9. To Distrib. add Campanian: Balsberg.

p. 215. To Synonymy of *Sulcocava sulcata* (d'Orb.) add *Sulcocava sulcata*, Hennig, *op. cit.* pp. 20–1, and fig. 8, p. 1. To Distrib. add Campanian: Köpinge, Mörby, Balsberg, etc.

p. 219. To Synonymy of *Entalophora virgula* (Hag.) add *Entalophorida proboscidea*, M. Edw., Hennig, *op. cit.* p. 16. To Distrib. add Danian: Annetorp. Also *Entalophorida proboscidea*, var. *rustica*, Hennig, *op. cit.* p. 17. To Distrib. add Campanian: Balsberg and Karlshamn.

p. 236. To Synonymy of *Entalophora madreporacea* (Goldf.) add *Entalophora madreporacea*, Goldf., Hennig, *op. cit.* p. 17. To Distrib. add Danian: Annetorp. Campanian: Karlshamn.

p. 257. To Synonymy of *Spiropora verticillata* (Goldf.) add *Spiropora verticillata*, Goldf., Hennig, *op. cit.* pp. 17–18. To Distrib. add Danian: Annetorp. Campanian: Qvarnby, Balsberg, Karlshamn, etc.

p. 278. To Synonymy of *Siphoniotyphlus johnstrupi* (Perg. & Meunier) add *Bisidmonea johnstrupi*, P. & M., Hennig, *op. cit.* p. 19. To Distrib. add Danian: Annetorp.

p. 325. To Synonymy of *Meliceritites gracilis* (Goldf.) add *Meliceritites gracilis*, Goldf., Hennig, *op. cit.* p. 40, pl. ii. fig. 43, and fig. 25, p. 40. To Distrib. add Campanian: Qvarnby, Köpinge, Mörby, Balsberg, etc.

p. 333. To Synonymy of *Meliceritites roemeri* (Hag.) add *Felicea* cf. *velata*, Hag., Hennig, *op. cit.* p. 39. To Distrib. add Campanian: Balsberg.

p. 345. To Synonymy of *Meliceritites? distans* (Hag.) add *Escharites distans* (Hag.), Hennig, *op. cit.* p. 19, and fig. 7, p. 19. To Distrib. add Campanian: Köpinge and Balsberg.

p. 374. To Synonymy of *Petalopora pulchella* (Röm.) add *Heteropora pulchella*, Röm., Hennig, *op. cit.* pp. 23–4, fig. 13. To Distrib. add Campanian: Köpinge, Ignaberga, Balsberg, etc.

p. 384. To Synonymy of *Sparsicavea carantina*, d'Orb., add *Heteropora carantina*, d'Orb., Hennig, *op. cit.* p. 24. To Distrib. add Campanian: Qvarnby.

p. 393. To Synonymy of *Sparsicavea dichotoma* (Goldf.) add *Heteropora dichotoma*, Goldf., Hennig, *op. cit.* pp. 22–3, fig. 12. To Distrib. add Campanian: Köpinge, Stafversvad, Balsberg, etc.

p. 406. To Synonymy of *Ditaxia anomalopora* (Goldf.) add *Ditaxia anomalopora*, Goldf., Hennig, *op. cit.* pp. 6–7, fig. 4, p. 7. To Distrib. add Campanian: Ifö.

p. 431. To Synonymy of *Reticulipora procera* (Hamm) add *Spiroclausa procera*, Hamm, Hennig, *op. cit.* p. 15. To Distrib. add Campanian: Balsberg.

LIST OF CHIEF LOCALITIES FOR CRETACEOUS BRYOZOA (EXCLUDING ENGLAND).

Locality.	Country.	Province or District.	Series.	Subseries or Zone.
Aachen (Aix-la-Chapelle)	Germany	Rhenish Prussia	Sen.	Campanian — Zone of *Actinocamax quadratus*.
Åhus	Sweden	Christianstad, Scania	Sen.	Campanian — Zone of *Belemnitella mucronata*.
Annetorp	Sweden	—	Danian	—
Balsberg	Sweden	Christianstad, Scania	Sen.	Campanian — Zone of *Belemnitella mucronata* (beds with *Actinocamax mamillatus*).
Barnakällegrottan	Sweden	Christianstad, Scania	Sen.	Campanian — Zone of *Belemnitella mucronata* (beds with *Actinocamax mamillatus*).
Baudrecourt	France	Haute-Marne	Neoc. (*fide* d'Orb.), Sen.	Hauterivian.
Beauvais	France	Oise	Sen.	Santonian—Craie blanche noduleuse.
Bemelen	Holland	Limburg, near Meressen	Sen.	Maastrichtian.
Berklingen	Germany	Brunswick	Neoc.	Hilsconglomerat.
Bezdekau	Bohemia	Randnitz	Tur.	Teplitzer Schichten.
Cachembach	France	Eure-et-Loir, near Chartres	Sen.	Santonian.
Cap de la Hève	France	Seine-Inférieure	Cen.	Craie glauconieuse.
Cas	France	Var	Tur.	—
Chavot	France	—	Sen.	—
Chinon	France	Indre-et-Loire	Tur.	Angoumian—Craie jaune de Touraine.
Ciply	Belgium	—	1. Danian 2. Sen.	Tuffeau de Ciply. Campanian—Tuffeau de Saint-Symphorien, with *Belemnitella mucronata*.
Collinière, La	France	—	Tur.	Angoumian — Zone of *Micraster breviporus*.
Croûtes, Les	France	Aube	Aptian	—
Epernay	France	Marne	Sen.	Campanian.
Essen	Germany	—	Cen.	Essener Grünsand.
Falkenberg (Valkenburg)	Holland	Limburg, east of Maastricht	Sen.	Maastrichtian.
Faxoe (Faxe)	Denmark	East coast of Zeeland	Danian	—
Fécamp	France	Seine-Inférieure	Sen.	Coniacian.
Fontenoy	France	Yonne	Neoc.	Hauterivian—Calcaire à Spatangues.
Fontevrault	France	Maine-et-Loire, south-east of Saumur	Sen.	Coniacian.

Locality.	Country.	Province or District.	Series.	Subseries or Zone.
Gehrden	Germany	Hannover	Sen.	Campanian — Ober Kreidemergel (*Mucronata* and *quadrata* Chalk).
Germain d'Arcé, St.	France	Sarthe, nr. Flèche, near Vaas	Tur.	—
Germain, St.	France	Near Paris	—	—
Geulhem	Holland	Near Maastricht	Sen.	Maastrichtian.
Gosau	Austria	Upper Austria	Sen.	Coniacian.
Goslar	Germany	Hannover	Neoc.	Hilsconglomerat.
Gross-Ujezd	Austria	Bohemia	Sen.	Iser-Schichten (probably Coniacian or Santonian).
Gropemöllan	Sweden	—	Sen.	Campanian — Zone of *Belemnitella mucronata* (beds with *Actinocamax mamillatus*).
Handorf	Austria	Bohemia	Tur.	Scaphitenkalk.
Hemmingslycke	Sweden	—	Sen.	Campanian — Zone of *Belemnitella mucronata*.
Hève, Cap de la	France	Seine-Inférieure	Cen.	Craie glauconieuse.
Ifö	Sweden	Christianstad, Scania	Sen.	Campanian — Zone of *Belemnitella mucronata* (beds with *Actinocamax mamillatus*).
Ignaberga	Sweden	Christianstad, Scania	Sen.	Campanian — Zone of *Belemnitella mucronata* (beds with *Actinocamax mamillatus*).
Île Madame	France	Charente-Inférieure	Cen.	Calcaire à Caprines.
Janières, Les	France	Sarthe	Up. Tur.	Angoumian.
Jiné	Austria	Bohemia	Cen.	Korycaner Schichten.
Joué-les-Tours	France	Indre-et-Loire	Sen.	Coniacian—Craie de Villedieu.
Kamajk	Austria	Bohemia	—	—
Kank	Austria	Bohemia	Cen.	Korycaner Schichten.
Karlshamn	Sweden	Blekinge	Sen.	Campanian — Zone of *Belemnitella mucronata* (beds with *Actinocamax mamillatus*).
Karup, Östra	Sweden	Halland	Sen.	Campanian — Zone of *Belemnitella mucronata* (beds with *Actinocamax mamillatus*).
Köpinge	Sweden	Christianstad, Scania	Sen.	Campanian — Zone of *Belemnitella mucronata*.
Lägerdorf	Germany	Schleswig	—	—
Lavardin	France	Loir-et-Cher	Tur.	Angoumian — Zone supérieure à *Terebratulina Bourgeoisi*.[1]

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[1] This horizon is recorded as Senonian by Pergens, Bull. Soc. belge Géol. 1893, vol. vi. p. 203.

Locality.	Country.	Province or District.	Series.	Subseries or Zone.
Lèves, Arche de	France	Eure-et-Loir, 2 km. north of Chartres	Sen.	Craie blanche (Santonian) or Craie marneuse.
Lisle	France	Loir-et-Cher, near Vendôme	Sen.	Coniacian.
Lisores	France	Calvados, near Vimoutiers	Cen.	Craie glauconieuse.
Luynes	France	—	Sen.	Coniacian.
Maastricht	Holland	Limburg	Sen.	Maastrichtian.
Madame, Île	France	Charente-Inférieure	Cen.	Calcaire à Caprines.
Magee Island	Ireland	Antrim	Sen. to Cen.	—
Mans, Le	France	Sarthe	Cen.	—
Maure, Ste.	France	Indre-et-Loire	Tur.	Craie jaune de Touraine.
Mazaugues (spelt also Mazorgues and Mazangues)	France	Var (sometimes quoted as in Bouches-des-Rhône)	Tur.	—
Merpins	France	Charente	Tur.	—
Meudon	France	Near Paris	Sen.	Campanian.
Mörby	Sweden	Christianstad, Scania	Sen.	Campanian — Zone of *Belemnitella mucronata*.
Moutier	France	Charente	Tur.	Angoumian.
Munet	France	Near Saumur, Maine-et-Loire	Sen.	Coniacian.
Nefgrab	Austria	West of Gosau, Upper Austria	Sen.	Coniacian.
Nehou	France	Manche	Sen.	Maastrichtian—Craie à baculites.
Nozeroy	France	Jura, nr. Poligny	Neoc.	Hauterivian and Valangian.
Olinge, Vestra	Sweden	Christianstad, Scania	Sen.	Campanian — Zone of *Belemnitella mucronata* (beds with *Actinocamax mamillatus*).
Oppmanna	Sweden	Christianstad, Scania	Sen.	Campanian — Zone of *Belemnitella mucronata* (beds with *Actinocamax mamillatus*).
Peine	Germany	34 km. east by south of Hannover	Sen.	—
Pérignac	France	Charente-Inférieure, near Saintes	Sen.	Probably Maastrichtian.
Petit-Lanaye	Holland	Limburg	Sen.	Maastrichtian.
Phelippeaux	France	Charente-Inférieure, near Jonzac	Sen.	Coniacian.
Pons	France	Charente-Inférieure	Sen.	Probably Maastrichtian.
Poodoopolliam	S. India	—	Tur. & Sen.	Arrialoor Series.
Quedlinburg	Prussia	Near Magdeburg	Sen.	Plänermergel.

Locality.	Country.	Province or District.	Series.	Subseries or Zone.
Qvarnby	Sweden	Scania	Sen.	Zone of *Belemnitella mucronata.*
Rheims	France	Marne	Sen.	Campanian — Zone of *Micraster fastigiatus*, etc.
Ribochère, La (= Villedieu)	France	Indre-et-Loire	Sen.	Coniacian—Craie noduleuse.
Roches, Les	France	Loir-et-Cher	Sen.	Coniacian—Craie de Villedieu.
Romorantin	France	Loir-et-Cher (Sologne)	Sen.	Santonian (*fide* Canu).
Royan	France	Charente-Inférieure	Sen.	Maastrichtian (but *fide* de Lapparent, Géol., 4th ed., vol. ii. p. 1386, it is Campanian).
Rügen	Germany	Island in Baltic, north-east of Stralsund	Sen.	Campanian.
Saint Calais	France	Sarthe	Up. Tur.	Angoumian.
St. Christophe	France	Indre-et-Loire	Sen.	Coniacian.
St. Colombe	France	Manche	Sen.	Maastrichtian—Craie à baculites.
Ste. Croix	Switzerland	Vaud	Neoc., mainly Valangian	Once quoted as Aptian by d'Orbigny, no doubt in error.
Ste. Maure	France	—	Tur.	Angoumian.
Ste. Paterne	France	Indre-et-Loire, at Villedieu	Sen.	Coniacian—Craie de Villedieu.
Ste. Rimay	France	Loir-et-Cher	Tur.	Craie marneuse.
Saintes	France	Charente-Inférieure	Sen.	Santonian.
Saints-en-Puisaye, Les	France	Yonne	Albian	—
Salzberg	Germany	Near Quedlinburg	Sen.	Plänermergel (Coniacian or Santonian).
Sarstedt	Germany	Hannover, 18 km. south-south-east of Hannover	Sen.	—
Schandelahe	Germany	Brunswick	Neoc.	Hilsconglomerat.
Schillinge	Austria	Bohemia, 17 miles west of Leitmeritz	Cen.	Lower Pläner.
Schöppenstedt	Germany	Brunswick, 10 miles east by south of Wolfenbüttel	Neoc.	Hilsconglomerat.
Sens	France	Yonne	Sen.	Santonian—Craie noduleuse (Zone of *Micraster coranguinum*).
Slieve Gallion	Ireland	Derry	Sen.	Campanian — Zone of *Belemnitella mucronata.*
Sougé	France	—	Tur.	Angoumian.

Locality.	Country.	Province or District.	Series.	Subseries or Zone.
Stafversvad	Sweden	—	Sen.	Campanian — Zone of *Belemnitella mucronata.*
Stevn's Klint	Denmark	Zeeland, the headland on the northern side of Faxoe Bay; it is north of the town of Lilledallen	Sen.	Campanian.
Südmerberg	Germany	Brunswick, near Goslar	Sen.	Santonian — Zone of *Marsupites.*
Timber Creek	United States	New Jersey	Sen.	Maastrichtian (Rancocas Division).
Torup, O.	Sweden	Malmöhus, Scania	—	—
Tours	France	Indre-et-Loire	Sen.	Coniacian—Craie de Villedieu.
Tourtenay	France	Deux Sevres	Tur. (*fide* d'Orbigny)	—
Trôo (Trôot)	France	—	Tur.	Angoumian.
Vaches Noires	France	Calvados, near Dives	Cen.	—
Valkenburg	Holland	Limburg, east of Maastricht	Sen.	Maastrichtian.
Vassy	France	Haute-Marne	Rhodanian	—
Vendôme	France	Loir-et-Cher	Sen.	Coniacian.
Villavard	France	Loir-et-Cher	Sen.	Coniacian—Craie de Villedieu.
Villecien	France	Yonne, 6 km. east-north-east of Joigny	Tur.	Angoumian — Zone of *Micraster breviporus*; Craie de Joigny.
Villedieu	France	Indre-et-Loire	Sen.	Coniacian—Craie noduleuse.
Villiers	France	Calvados	Cen.	—
Vincentown	United States	New Jersey	Sen.	Maastrichtian (Rancocas Division).

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pp. 1–40, 1841.
pp. 41–72, 1842.
pp. 73–104, 1843.
pp. 105–144, 1844.
pp. 145–184, 1845.
pp. 185–248, 1846.
pp. 249–328, 1847.
pp. 329–348, 1848.

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pp. 1–188,	pl. 600 to probably pl. 683,	1851.
pp. 189–472,	pls. 684–761 ...	1852.
pp. 473–984,	pls. 762–800 ...	1853.
pp. 985–1192	... ...	1854.

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EXPLANATION OF PLATES.

PLATE I.

Fig. 1. *Actinopora brongniarti* (Edw.). Upper Chalk : Dover. Incrusting on *Echinocorys scutatus.* × 10 dia. J. S. Gardner Coll. [D. 3098.]

Fig. 2. *Actinopora brongniarti* (Edw.), var. *cretacea*, d'Orb. Upper Chalk : South of England. × 10 dia. Butler Coll. [D. 4477.]

Fig. 3. *Actinopora disticha* (Hag.), var. *gaudryana* (d'Orb.). Upper Chalk : loc. ? × 10 dia. Morris Coll. [D. 4582.]

Fig. 4. *Actinopora complanata* (Röm.). Upper Chalk : Bromley. × 10 dia. Bowerbank Coll. [D. 3109.]

Fig. 5. *Actinopora complanata* (Röm.). Middle Chalk : Chatham. × 10 dia. Vine Coll. [D. 2695.]

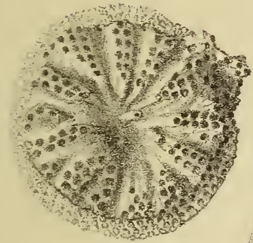
Fig. 6. *Actinopora complanata* (Röm.), var. *subdisciformis*, d'Orb. Middle Chalk : Chatham. × 7 dia. Gamble Coll. [D. 4245.]

Fig. 7. *Actinopora convexa* (Röm.). Upper Chalk : loc. ? Fig. 7*a*, the upper surface of the zoarium, × 10 dia. ; Fig. 7*b*, the zoarium from the side, nat. size. Morris Coll. [50,460.]

Fig. 8. *Discocavea irregularis* (d'Orb.). Middle Chalk : Chatham. Fig. 8*a*, the upper surface of the zoarium, × 10 dia. ; Fig. 8*b*, the zoarium from the side, nat. size. Vine Coll. [D. 2757.]

Fig. 9. *Discocavea irregularis* (d'Orb.). Upper Chalk : loc. ? Fig. 9*a*, the upper surface of the zoarium, × 7 dia. ; Fig. 9*b*, the zoarium from the side, nat. size. Morris Coll. [50,468.]

Fig. 10. *Discocavea longiradiata.* Lower Chalk : Southern Pit. Fig. 10*a*, the upper surface of the zoarium, × 3 dia. ; Fig. 10*b*, part of the same specimen, × 10 dia. Capron Coll. [D. 4587.]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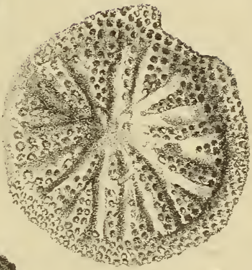
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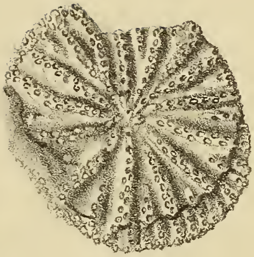
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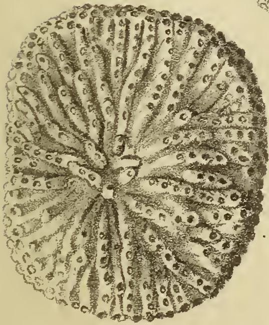
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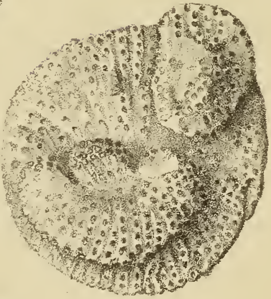
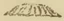

6. × 7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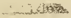
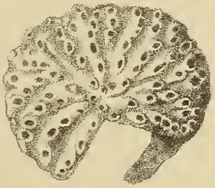
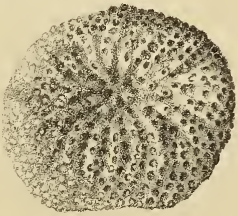

9b.


5. × 10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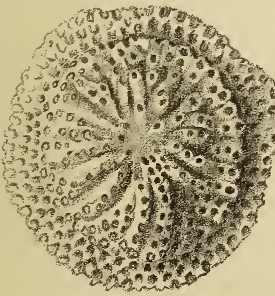
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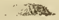
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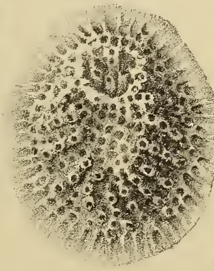
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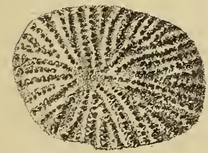
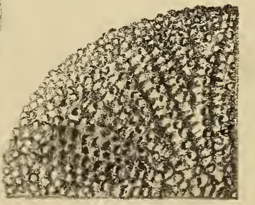

10a. × 3


10b. × 10

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West, Newman imp.

Actinopora, & Discocavea.

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PLATE II.

Fig. 1. *Discocytis profunda*, Greg. Chalk: Charing, Kent. × 16 dia. Jones Coll. [D. 2851.]

Fig. 2. *Discocytis profunda*, Greg. Chalk : Charing, Kent. × 16 dia. Jones Coll. [D. 2851.]

Fig. 3. *Discocytis profunda*, Greg. Chalk : Charing, Kent. The upper surface of a third specimen ; × 16 dia. Jones Coll. [D. 2851.]

Fig. 4. *Bicavea rotaformis*, Greg. Lower Chalk : Freshwater, Isle of Wight. The upper surface ; × 8 dia. Capron Coll. [D. 2996.]

Fig. 5. *Bicavea rotaformis*, Greg. Lower Chalk : Freshwater, Isle of Wight. The under surface and part of the stem ; × 7 dia. Capron Coll. [D. 2996.]

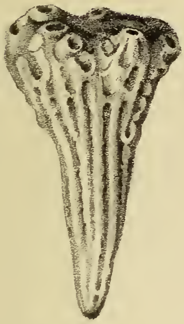
Fig. 6. *Bicavea rotaformis*, Greg. Upper Chalk : loc. ? Two zoaria growing from the same stem ; × 6 dia. Old Coll. [D. 2997.]

Fig. 7. *Homœosolen virgulosus*, Greg. Middle Chalk — Zone of *Micraster cortestudinarium* : Chatham. Fig. 7*a*, the obverse face of a young zoarium, × 6 dia. ; Fig. 7*b*, the obverse face of the shorter branch and the reverse face of the longer branch of the same zoarium, × 6 dia. Gamble Coll. [D. 3959.]

Fig. 8. *Homœosolen virgulosus*, Greg. Middle Chalk — Zone of *Micraster cortestudinarium* : Chatham. Fig. 8*a*, the obverse surface of a still younger zoarium, × 6 dia. ; Fig. 8*b*, the reverse surface of the same specimen, × 6 dia. Vine Coll. [D. 689.]

Fig. 9. *Homœosolen fenestratus*, d'Orb. Middle Chalk — Zone of *Micraster cortestudinarium* : Chatham. The obverse surface of a variety with long pinnules ; × 11 dia. Gamble Coll. [D. 3968.]

Fig. 10. *Homœosolen fenestratus*, d'Orb. Middle Chalk — Zone of *Micraster cortestudinarium* : Chatham. The reverse surface of another specimen with long pinnules ; × 11 dia. Gamble Coll. [D. 3968.]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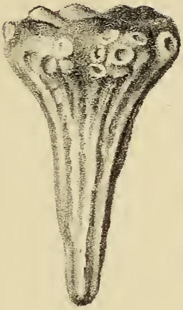
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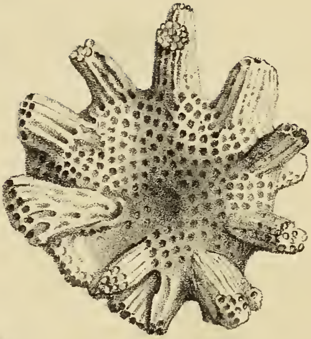
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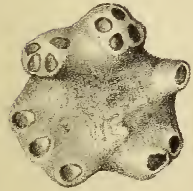
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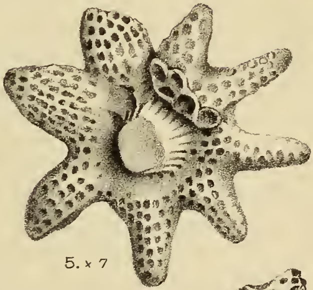
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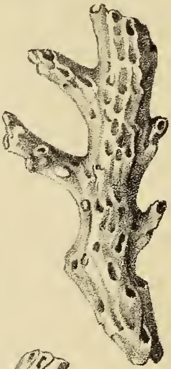
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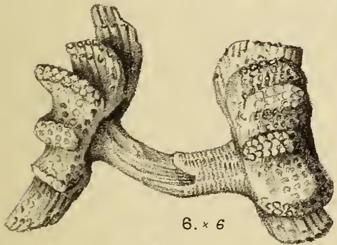
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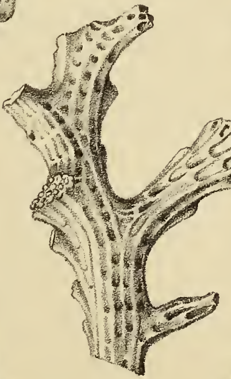
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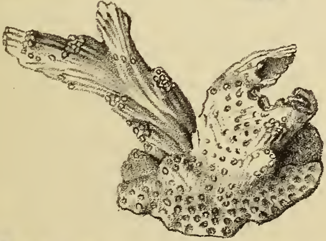
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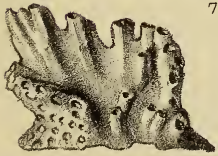
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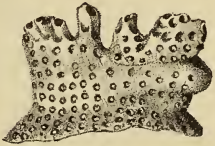
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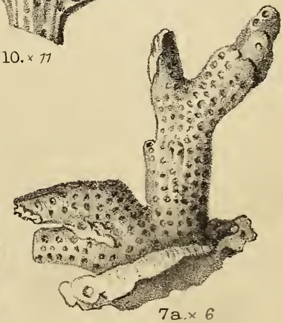

7a. × 6

E. Drake del. et lith.

West, Newman imp.

Cretaceous Bryozoa.

BRITISH MUSEUM NATURAL HISTORY

PLATE III.

FIG. 1. *Homœosolen virgulosus*, Greg. Middle Chalk — Zone of *Micraster cortestudinarium*: Chatham. Reverse face of the zoarium, showing the lateral processes; × 8 dia. Gamble Coll. [D. 395.]

FIG. 2. *Trochiliopora humei*, Greg. Middle Chalk: ? Gravesend. Fig. 2*a*, the type-specimen from the side, × 3 dia.; Fig. 2*b*, the upper surface of the same specimen, × 3 dia. ? Bowerbank Coll. [D. 2995.]

FIG. 3. *Semicytis rugosa*, d'Orb. Middle Chalk—Zone of *Micraster cortestudinarium*: Chatham. Fig. 3*a*, the obverse surface of a stem, with somewhat irregular pinnules, × 11 dia.; Fig. 3*b*, the reverse surface of the same specimen, × 11 dia. Gamble Coll. [D. 3966.]

FIG. 4. *Semicytis rugosa*, d'Orb. Middle Chalk—Zone of *Micraster cortestudinarium*: Chatham. A nearly complete zoarium, showing the obverse surface; × 4 dia. Gamble Coll. [D. 3967.]

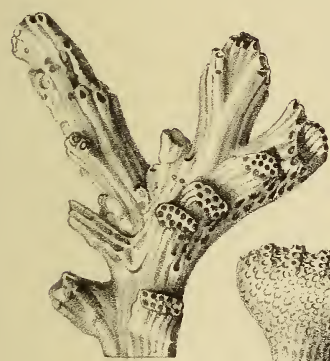
FIG. 5. *Homœosolen fenestratus*, d'Orb. Middle Chalk — Zone of *Micraster cortestudinarium*: Chatham. Obverse face of the base of a zoarium with gonœcium; × 15 dia. Gamble Coll. [D. 4365.]

FIG. 6. *Homœosolen fenestratus*, d'Orb. Middle Chalk — Zone of *Micraster cortestudinarium*: Chatham. Obverse face of a fragment with long pinnules; × 12 dia. Gamble Coll. [D. 4365.]

FIG. 7. *Homœosolen ramulosus*, Lonsd. Middle Chalk — Zone of *Micraster cortestudinarium*: Chatham. Part of a branch showing the whole of a pinnule and a gonœcium; × 10 dia. Gamble Coll. [D. 407.]

FIG. 8. *Homœosolen disparilis* (d'Orb.). Upper Chalk: Gravesend. Fig. 8*a*, the whole zoarium, nat. size; Fig. 8*b*, obverse face of one branch, × 6 dia.; Fig. 8*c*, the reverse face of a branch, × 6 dia. Harford Coll. [D. 7281.]

FIG. 9. *Desmepora blackmorei*, Greg. Upper Chalk—Zone of *Actinocamax quadratus*: East Harnham. Fig. 9*a*, part of the obverse surface, × 6 dia.; Fig. 9*b*, part of the side of a branch, showing the edge of the pinnules and the groups of apertures, × 6 dia. Gamble Coll. [D. 4328.]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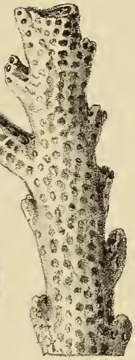
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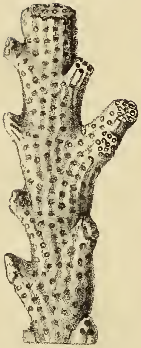
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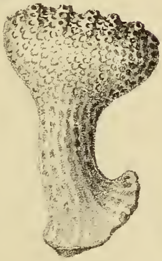
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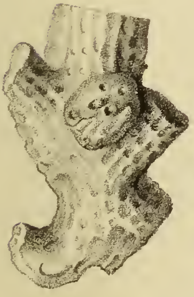
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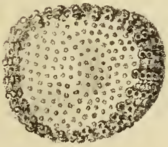
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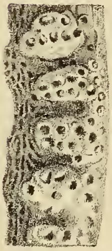
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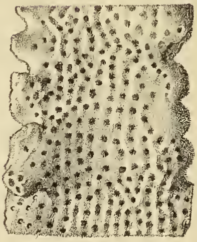
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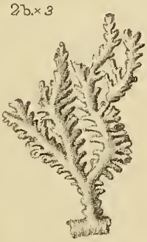
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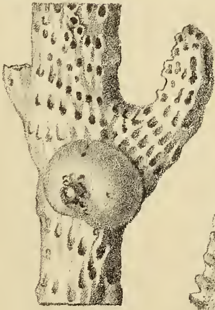
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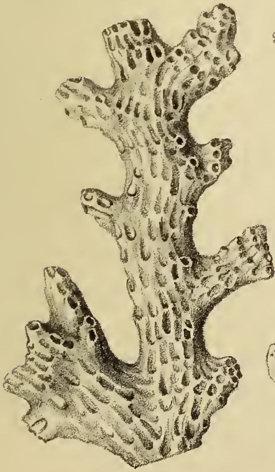
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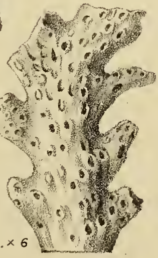
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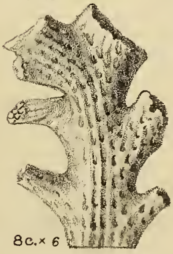
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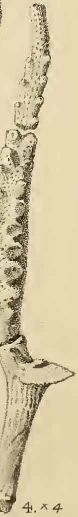

4. × 4

E. Drake del. et lith.		West, Newman imp.

Cretaceous Bryozoa.

BRITISH MUSEUM NATURAL HISTORY

PLATE IV.

Fig. 1. *Desmepora pinnigera*, Greg. Middle Chalk: Rochester. Fig. 1*a*, the type-specimen, nat. size; Fig. 1*b*, part of one branch, × 7 dia. J. Simmonds Coll. [D. 7282.]

Fig. 2. *Homœosolen ramulosus*, Lonsd. Upper Chalk: loc.? Fig. 2*a*, a worn specimen, to which a lamellibranch has grown attached, × 2 dia.; Fig. 2*b*, part of the main stem of the same specimen, × 10 dia. Old Coll. [D. 4576.]

Fig. 3. *Fasciculipora cretacea*, d'Orb. Upper Chalk: Gravesend. Fig. 3*a*, a zoarium, nat. size; Fig. 3*b*, end of a branch, × 15 dia. Bowerbank Coll. [D. 2611.]

Fig. 4. *Discofascigera ligeriensis*, d'Orb. Upper Chalk: Magee Island, Ireland. A zoarium from the side; × 10 dia. Presented by Jos. Wright, Esq. [D. 3278.]

Fig. 5. *Discofascigera paucipora* (Vine). Cambridge Greensand: Cambridge. Fig. 5*a*, the type-specimen from above, × 12 dia.; Fig. 5*b*, a thin section across the base of the head of the same specimen, × 12 dia. Jesson Coll. [D. 1857.]

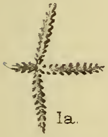
Fig. 6. *Discofascigera vinei*, Greg. Cambridge Greensand: Cambridge. The *Lichenopora compressa*, ?d'Orb. of Vine. × 10 dia. Jesson Coll. [D. 1863.]

Fig. 7. *Tholopora colligata* (Greg.). Lower Greensand: Farringdon. Fig. 7*a*, the zoarium from above, nat. size; Fig. 7*b*, the upper surface of the end of one branch, × 8 dia. ?Baker Coll. [D. 7288.]

Fig. 8. *Radiopora tuberculata*, d'Orb. Cambridge Greensand: Cambridge. Fig. 8*a*, the zoarium from the side, nat. size; Fig. 8*b*, part of the surface of the same specimen, × 8 dia. [D. 3159.]

Fig. 9. *Zonatula favus* (Seeley). Red Chalk: Hunstanton. The specimen recorded by Vine as *Zonopora ? irregularis*, d'Orb.; × 6 dia. Jesson Coll. [D. 2057.]

Fig. 10. *Zonatula brydonei*, Greg. Lower Greensand: Farringdon. Fig. 10*a*, the zoarium from the side, nat. size; Fig. 10*b*, part of the surface of the same specimen, × 10 dia. Mantell Coll. [10,297.]



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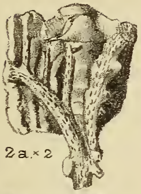

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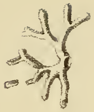

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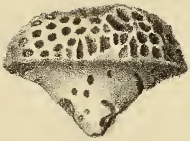

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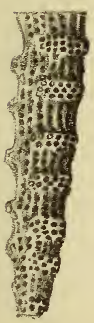

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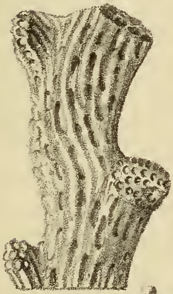

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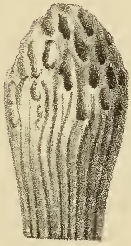

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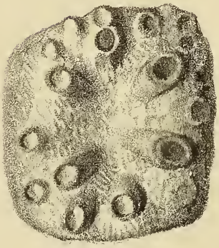

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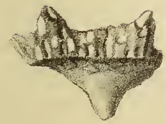

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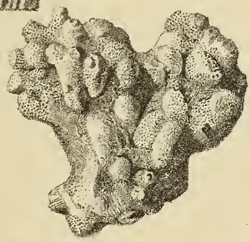

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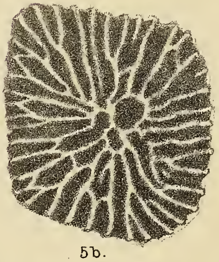

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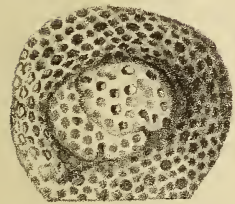

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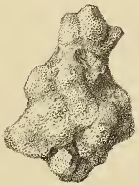
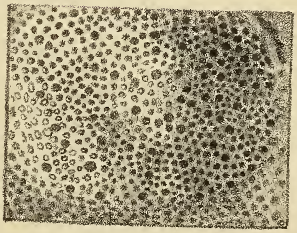
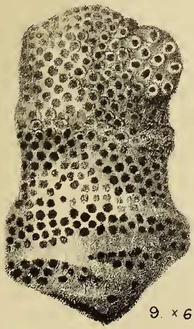


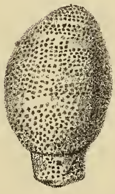
8a.



8b. × 8



9. × 6.



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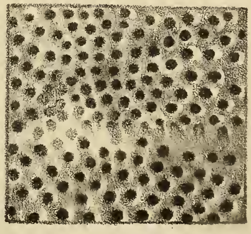


10b. × 10

E. Drake del. et lith.

West, Newman imp.

PLATE V.

Fig. 1. *Ceriopora farringdonensis*, Greg. Lower Greensand: Farringdon. The upper surface of the type-specimen; nat. size. Mantell Coll. [10,298?]

Fig. 2. Part of the same specimen; × 8 dia. Mantell Coll. [10,298.]

Fig. 3. *Ceriopora farringdonensis*, Greg. Lower Greensand: Farringdon. Side view of a more tuberous specimen; nat. size. Cunnington Coll. [D. 7290.]

Fig. 4. *Ceriopora farringdonensis*, Greg. Lower Greensand: Farringdon. A young zoarium; nat. size. Sharp Coll. [D. 7291.]

Fig. 5. *Ceriopora collis* (d'Orb.) and *Semimulticavea variolata*, n.sp., growing on a *Terebratula*. Lower Greensand: Farringdon. Fig. 5*a*, the specimen, nat. size; Fig. 5*b*, *Ceriopora collis*, part of the zoarium, × 12 dia.; Fig. 5*c*, *Semimulticavea variolata*, part of the surface, × 12 dia. [D. 3027.]

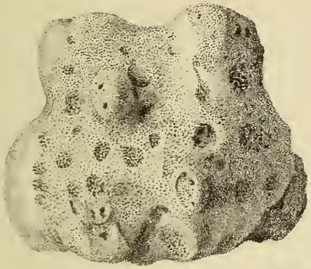
Fig. 6. *Multicrescis variabilis*, d'Orb. Upper Greensand: Haldon Hills. Fig. 6*a*, the zoarium from the side, nat. size; Fig. 6*b*, part of the zoarium, × 10 dia. [D. 3179.]

Fig. 7. *Heteropora keepingi*, Greg. Lower Greensand: Coxwell, Farringdon. Fig. 7*a*, the zoarium from the side, nat. size; Fig. 7*b*, part of the surface, × 10 dia. Cunnington Coll. [D. 7292.]

Fig. 8. *Heteropora keepingi*, Greg. Lower Greensand: loc.? The zoarium, nat. size; a section of this specimen is shown as Fig. 50, p. 191. [B. 118.]

Fig. 9. *Ceriopora confusa* (Loriol). Lower Greensand: Shanklin, Isle of Wight. The zoarium from the side; nat. size. Westlake Coll. [D. 3020.]

Fig. 10. *Choristopora impar*, Lonsd. Lower Greensand: Shanklin, Isle of Wight. Fig. 10*a*, the zoarium from the side, nat. size; Fig. 10*b*, part of the surface, × 9 dia.; Fig. 10*c*, thin transverse section, × 8 dia. M. Norman Coll. [D. 3147.]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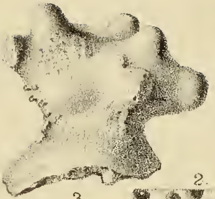
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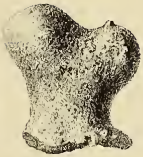
4

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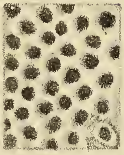

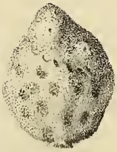
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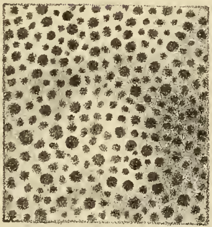
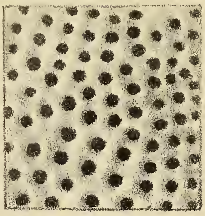
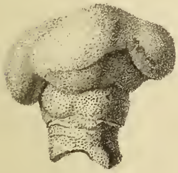
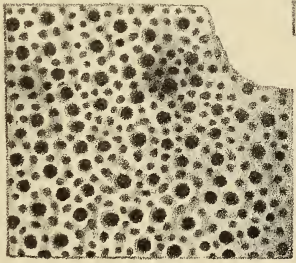
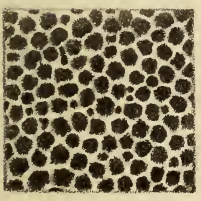
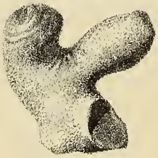

5c. × 72

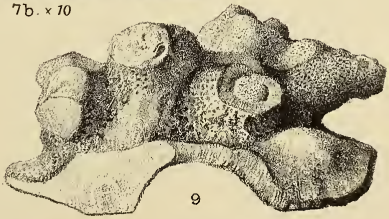

5b. × 72


6a.


7b. × 10


6b. × 10


8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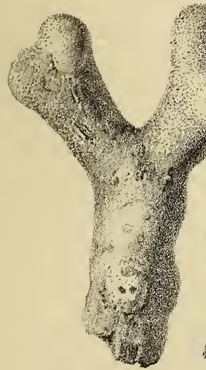
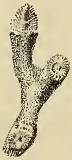
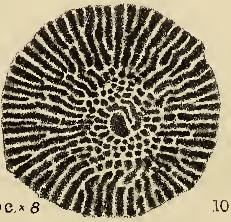
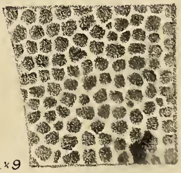

7a.


10a.


10c. × 8


10b. × 9

E. Drake del. et lith.
West, Newman imp.

PLATE VI.

FIG. 1. *Plethopora arbuscula*, Filliozat. Senonian — Coniacian : Villavard, Loir-et-Cher. Fig. 1*a*, the zoarium from the side, × 5 dia. ; Fig. 1*b*, part of the same, × 1⅛ dia. [D. 4924.]

FIG. 2. *Osculipora repens* (Hag.). Senonian — Maastrichter Kalk : Maastricht. Obverse face of a zoarium ; × 4 dia. Vine Coll. [D. 1386.]

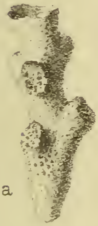
FIG. 3. *Osculipora repens* (Hag.). Senonian — Maastrichter Kalk : Maastricht. Basal part of another zoarium, showing the reverse surface and one side ; × 4 dia. Vine Coll. [D. 1386.]

FIG. 4. *Homœosolen carinatus* (Reuss). Cambridge Greensand : Cambridge. Fig. 4*a*, the obverse face, × 10 dia. ; Fig. 4*b*, the reverse face of the same specimen, × 10 dia. ; Fig. 4*c*, the end of the stem from above, × 15 dia. Jesson Coll. [D. 1874.]

FIG. 5. *Homœosolen carinatus* (Reuss). Cambridge Greensand : Cambridge. Fig. 5*a*, the obverse face of the zoarium, × 6 dia. ; Fig. 5*b*, the reverse face of the same specimen. Jesson Coll. [D. 1880.]

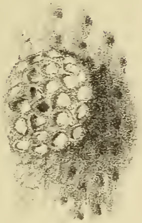
FIG. 6. *Defranciopora libiformis*, Greg. Senonian — Maastrichter Kalk : Maastricht. Fig. 6*a*, the type-specimen from the side, × 6½ dia. ; Fig. 6*b*, part of the rim of a segment of the same specimen, × 30 dia. Vine Coll. [D. 1398.]

FIG. 7. *Fasciculipora spicata*, Greg. Senonian—Campanian : Ciply. Fig. 7*a*, a broken zoarium from the side, × 5 dia. ; Fig. 7*b*, the same from above, × 5 dia. ; Fig. 7*c*, part of one side of the zoarium, × 10 dia. ; Fig. 7*d*, the upper end of a spike, × 10 dia. Hottelart Coll. [30,746.]



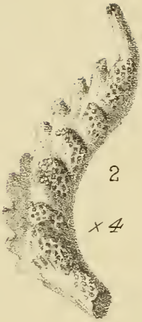
1a

x5



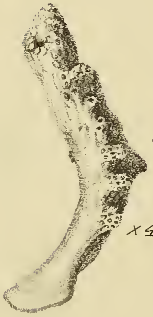
1b

x18



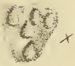
2

x4



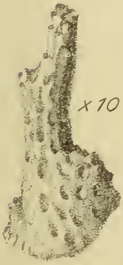
3

x4



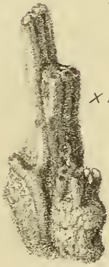
4c

x15



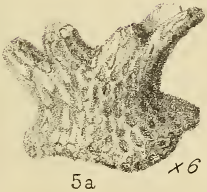
4a

x10



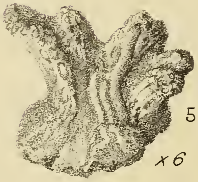
4b

x10



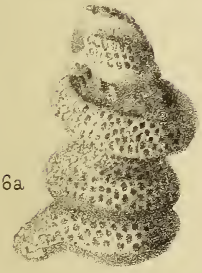
5a

x6



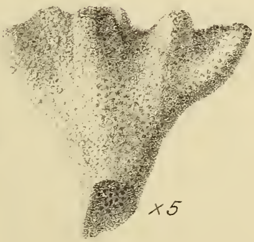
5b

x6



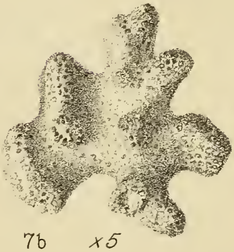
6a

x 6½



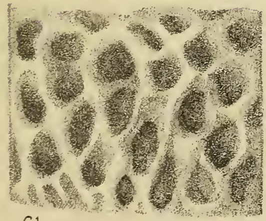
7a

x5



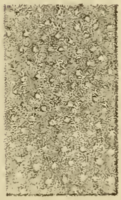
7b

x5



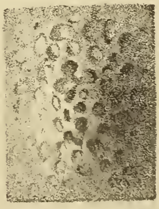
6b

x30



7c

x10



7d

x 10

E. Drake del. et lith.

West, Newman imp.

BRITISH MUSEUM NATURAL HISTORY

PLATE VII.

FIG. 1. *Defrancipora cochloidea* (Hag.). Senonian — Maastrichter Kalk: Maastricht. Fig. 1*a*, a zoarium from the side, × 6 dia.; Fig. 1*b*, the upper surface of the same specimen. Gamble Coll. [D. 3777.]

FIG. 2. *Fungella dujardini*, Hag. Senonian — Maastrichter Kalk: Maastricht. Fig. 2*a*, a zoarium from the side, × 2 dia.; Fig. 2*b*, part of the upper surface of the same specimen, × 10 dia. Van Breda Coll. [D. 3292.]

FIG. 3. *Discofascigera paucipora* (Vine). Cambridge Greensand: Cambridge. Fig. 3*a*, the upper surface of a zoarium, × 8 dia.; Fig. 3*b*, the same specimen from the side, × 8 dia. Jesson Coll. [D. 1864.]

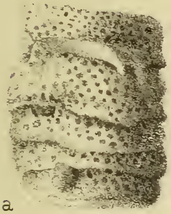
FIG. 4. *Zonatula pseudotorquata* (Hag.). Senonian — Maastrichter Kalk: Maastricht. Fig. 4*a*, a zoarium from the side, × 2 dia.; Fig. 4*b*, upper surface of the same specimen, showing a transverse section across the main stem and oblique section across a branch, × 3 dia. Van Breda Coll. [D. 3366.]

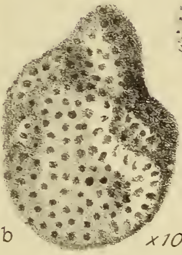
FIG. 5. *Zonatula pseudotorquata* (Hag.), var. *annulata*. Senonian—Maastrichter Kalk: Maastricht. Fig. 5*a*, the zoarium from the side; Fig. 5*b*, part of the surface, × 6 dia. Van Breda Coll. [60,164.]

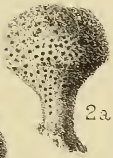
FIG. 6. *Reptomulticava fungiformis*, Greg. Lower Greensand: Farringdon. Fig. 6*a*, the type-specimen from the side, nat. size; Fig. 6*b*, part of the surface of the same specimen, × 10 dia. Caleb Evans Coll. [D. 3014.]

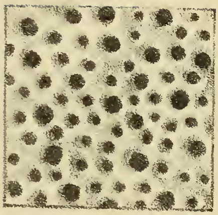
FIG. 7. *Zonatula favus* (Seeley). Red Chalk: Hunstanton. A young zoarium from the side; × 3 dia. Jesson Coll. [D. 2046.]

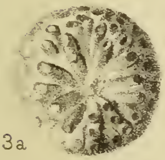
FIG. 8. *Tholopora vinei* (Greg.). Cambridge Greensand: Cambridge. The type-specimen from the side; × 5 dia. Jesson Coll. [D. 1879.]

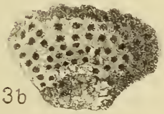

1a
×6

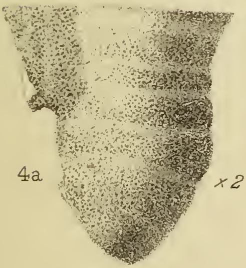

1b
×10

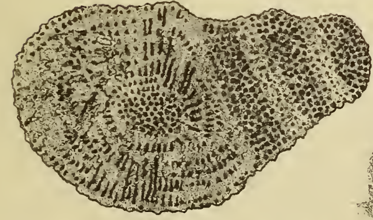

2a
×2

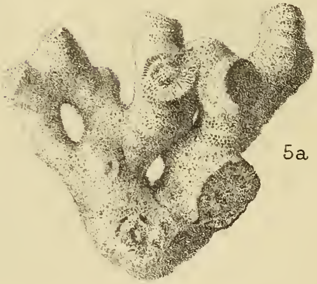

2b.
×10

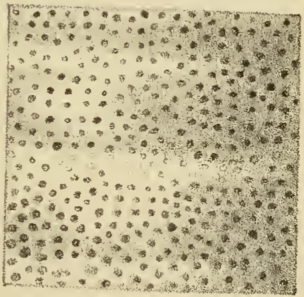

3a
×8

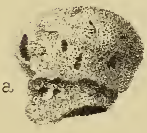

3b
×8

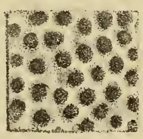

4a
×2

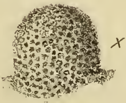

4b
×3

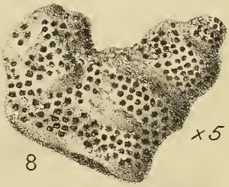

5a


5b
×6


6a


6b
×10


7
×3


8
×5

E. Drake del. et lith.

West, Newman imp.

BRITISH MUSEUM NATURAL HISTORY

PLATE VIII.

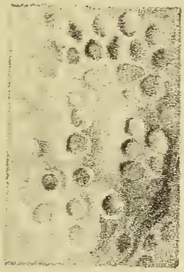
FIG. 1. *Tholopora vinei* (Greg.). Cambridge Greensand : Cambridge. Part of the surface ; × 15 dia. Jesson Coll. [D. 1881.]

FIG. 2. *Tholopora cantiana* (Greg.). Upper Chalk : Bromley. A zoarium from the side ; × 5 dia. J. Simmons Coll. [D. 2849.]

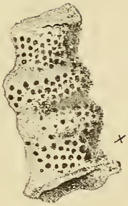
FIG. 3. *Tholopora cantiana* (Greg.). Middle Chalk—Zone of *Micraster cortestudinarium* : Chatham. The type-specimen from the side ; × 5 dia. Vine Coll. [D. 2759.]

FIG. 4. *Heteropora subæquiporosa*, Greg. Upper Greensand : Warminster. Fig. 4*a*, the zoarium from the side, nat. size ; Fig. 4*b*, the upper end of the zoarium, nat. size ; Fig. 4*c*, part of the surface, × 10 dia. J. Brown Coll. [D. 3177.]

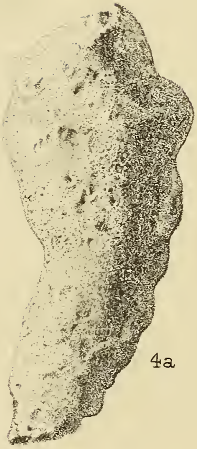
FIG. 5. *Heteropora michelini* (d'Orb.), var. *coalescens*. Upper Greensand—Zone of *Schlœnbachia rostrata* : Haldon. Fig. 5*a*, the whole zoarium, nat. size; Fig. 5*b*, part of the surface, × 10 dia. Vicary Coll. [D. 7400.]



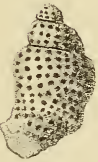
1 ×15



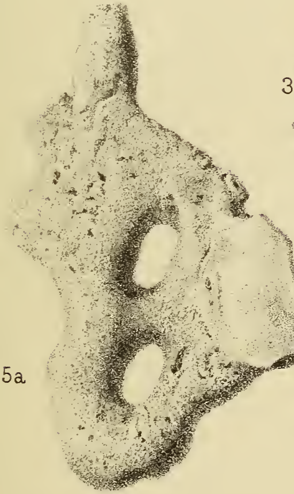
2 ×5



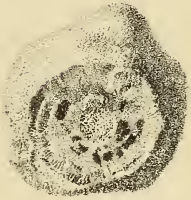
4a



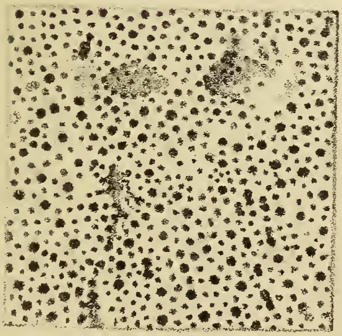
3 ×5



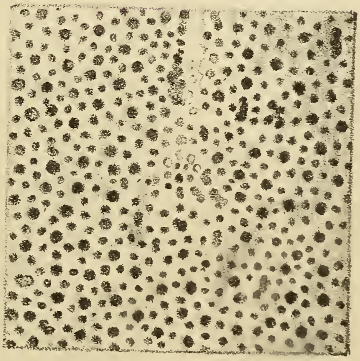
5a



4b



5b ×10



4c ×10

E.Drake del.et lith.

West, Newman imp.

BRITISH MUSEUM
NATURAL HISTORY

PLATE IX.

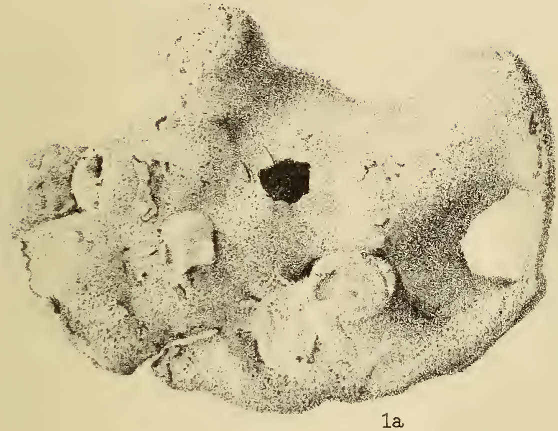
Fig. 1. *Heteropora michelini* (d'Orb.), var. *lobata*. Upper Greensand —Zone of *Schlœnbachia rostrata*: Haldon. Fig. 1*a*, the whole zoarium, nat. size ; Fig. 1*b*, part of the surface, × 10 dia. Vicary Coll. [D. 7399.]

Fig. 2. *Heteropora michelini* (d'Orb.), var. *cylindrica*. Upper Greensand —Zone of *Schlœnbachia rostrata* : Haldon. Fig. 2*a*, the zoarium from above, nat. size ; Fig. 2*b*, part of the surface, × 10 dia. Vicary Coll. [D. 7405.]

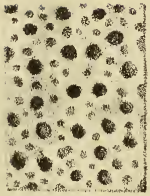
Fig. 3. *Reptomulticava micropora* (Römer). Neocomian — Hilsconglomerat : Berklingen, Brunswick. Part of the surface ; × 10 dia. Saemann Coll. [D. 3645.]

Fig. 4. *Multicrescis tuberosa* (Römer). Neocomian—Hilsconglomerat : Goslar, Hannover. Fig. 4*a*, the side view of the zoarium, × 3 dia. ; Fig. 4*b*, vertical section through the same specimen, × 3 dia. [D. 7075*a*.]

Fig. 5. *Pergensella geniculata* (Hag.). Senonian—Maastrichter Kalk : Maastricht. An exceptionally well - preserved specimen. Fig. 5*a*, the obverse surface, × 5 dia. ; Fig. 5*b*, side view of the same specimen, × 5 dia. Van Breda Coll. [D. 3526.]

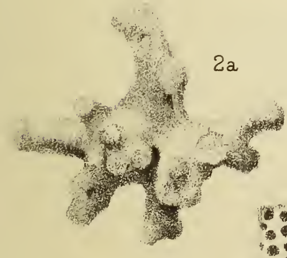


1a

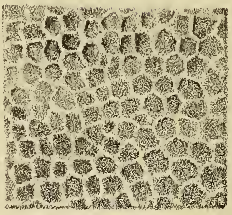


1b

×10

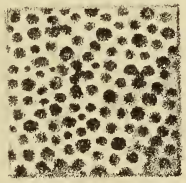


2a



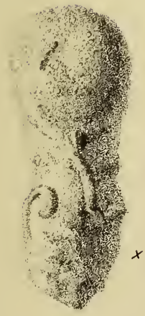
3

×10



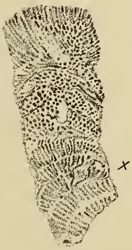
2b.

×10



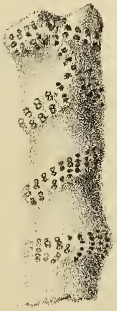
×3

4a



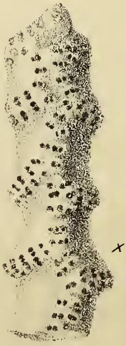
×3

4b



×5

5b



×5

5a

E.Drake del.et lith.

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British Museum (Natural History),
Cromwell Road,
London, S.W.
September, 1909.

LONDON:
PRINTED FOR HIS MAJESTY'S STATIONERY OFFICE,
BY DARLING & SON, LTD., 34-40, BACON STREET, E.

1909.